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Southeast Alaska Steelhead Snorkel Surveys of Regional Index Streams, 2012 and 2013

by

Carol L. Coyle

and

Jeff Nichols

October 2016

Alaska Department of Fish and Game **Divisions of Sport Fish and Commercial Fisheries**

Symbols and Abbreviations

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Weights and measures (metric)

centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
meter	m
milliliter	mL
millimeter	mm

Weights and measures (English)

cubic feet per second	ft^3/s
foot	ft
gallon	gal
inch	in
mile	mi
nautical mile	nmi
ounce	oz
pound	lb
quart	qt
yard	yd

Time and temperature

day	d
degrees Celsius	°C
degrees Fahrenheit	°F
degrees kelvin	K
hour	h
minute	min
second	s

Physics and chemistry

all atomic symbols	
alternating current	AC
ampere	A
calorie	cal
direct current	DC
hertz	Hz
horsepower	hp
hydrogen ion activity (negative log of)	pH
parts per million	ppm
parts per thousand	ppt, ‰
volts	V
watts	W

General

Alaska Administrative Code	AAC
all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.
all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.
at	@
compass directions:	
east	E
north	N
south	S
west	W
copyright	©
corporate suffixes:	
Company	Co.
Corporation	Corp.
Incorporated	Inc.
Limited	Ltd.
District of Columbia	D.C.
et alii (and others)	et al.
et cetera (and so forth)	etc.
exempli gratia (for example)	e.g.
Federal Information Code	FIC
id est (that is)	i.e.
latitude or longitude	lat or long
monetary symbols (U.S.)	$, ¢
months (tables and figures): first three letters	Jan,...,Dec
registered trademark	®
trademark	™
United States (adjective)	U.S.
United States of America (noun)	USA
U.S.C.	United States Code
U.S. state	use two-letter abbreviations (e.g., AK, WA)

Mathematics, statistics

all standard mathematical signs, symbols and abbreviations	
alternate hypothesis	H_A
base of natural logarithm	*e*
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	(F, t, χ^2, etc.)
confidence interval	CI
correlation coefficient (multiple)	R
correlation coefficient (simple)	r
covariance	cov
degree (angular)	°
degrees of freedom	df
expected value	*E*
greater than	>
greater than or equal to	≥
harvest per unit effort	HPUE
less than	<
less than or equal to	≤
logarithm (natural)	ln
logarithm (base 10)	log
logarithm (specify base)	$\log_2$, etc.
minute (angular)	'
not significant	NS
null hypothesis	H_O
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	α
probability of a type II error (acceptance of the null hypothesis when false)	β
second (angular)	"
standard deviation	SD
standard error	SE
variance	
population	Var
sample	var

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by
Carol L. Coyle
and
Jeff Nichols
Alaska Department of Fish and Game, Division of Sport Fish, Douglas

Alaska Department of Fish and Game
Division of Sport Fish, Research and Technical Services
333 Raspberry Road, Anchorage, Alaska, 99518-1599

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Carol L. Coyle and Jeff Nichols [a]
Alaska Department of Fish and Game, Division of Sport Fish
802 3rd St., Douglas, AK 99824
P.O. Box 110024, Juneau, AK 99811, USA

[a] *Author to whom all correspondence should be addressed: jeff.nichols@alaska.gov*

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TABLE OF CONTENTS

Page

LIST OF TABLES ii
LIST OF FIGURES ii
LIST OF APPENDICES ii
ABSTRACT 1
INTRODUCTION 1
OBJECTIVE 2
METHODS 2
Southeast Alaska Snorkel Surveys 2
Stream Temperature Monitoring 4
RESULTS 4
Southeast Alaska Snorkel Surveys: 2012 4
Southeast Alaska Snorkel Surveys: 2013 4
Southeast Alaska Snorkel Surveys: Historical Evaluation of Median Trend Line and index count 5
Stream Temperature Monitoring 5
DISCUSSION 5
ACKNOWLEDGMENTS 8
REFERENCES CITED 9
TABLES AND FIGURES 13
APPENDIX A: STEELHEAD COUNTS 2012–2013 27
APPENDIX B: STEELHEAD INDEX STREAMS SURVEYED BY ADF&G, 1997–2013 37
APPENDIX C: WHITE RIVER 39
APPENDIX D: WARD CREEK 43
APPENDIX E: HARRIS RIVER 47
APPENDIX F: EAGLE/LUCK CREEK 51
APPENDIX G: PETERSBURG CREEK 55
APPENDIX H: SLIPPERY CREEK 59
APPENDIX I: FORD ARM CREEK 63
APPENDIX J: SITKOH CREEK 67
APPENDIX K: PLEASANT BAY CREEK 71
APPENDIX L: PETERSON CREEK 75
APPENDIX M: ARCHIVED DATA 81

LIST OF TABLES

Table **Page**

1. Steelhead index streams surveyed in 2012 along with dates of peak or high counts....14
2. Steelhead index streams surveyed in 2013 along with dates of peak or high counts....15
3. Steelhead snorkel survey counts collected on current and past index streams in Southeast Alaska, 1997–2013....16

LIST OF FIGURES

Figure **Page**

1. Locations of the Situk River and the steelhead index systems in Southeast Alaska surveyed in 2012 and 2013....17
2. Annual deviations from the median peak snorkel survey count and the average annual deviation for Southeast Alaska steelhead snorkel surveys, 1997-2013....18
3. The daily high, low, and average water temperatures recorded at steelhead index streams and the dates of "high" or "peak" snorkel counts during the 2012 and 2013 Southeast Alaska steelhead snorkel surveys....19

LIST OF APPENDICES

Appendix **Page**

A1. Steelhead index stream name, anadromous stream number, management area, length and percent of stream surveyed, number of survey reaches, and approximate dates for start of weekly surveys for steelhead in 2012 and 2013. 28
A2. Counts of steelhead from 2012 surveys by date, stream, and reach of stream along with measured environmental variables. 29
A3. Counts of steelhead from 2013 surveys by date, stream and reach of stream along with measured environmental variables. 33
B1. Present and past steelhead index streams surveyed by ADF&G DSF from 1997–2013. 38
C1. White River, Ketchikan Index Stream: AWC # 101-45-10240. 40
C2. Description and history of White River steelhead surveys, research and management. 41
D1. Ward Creek, Ketchikan Index Stream: AWC # 101-47-10150. 44
D2. Description and history of Ward Creek steelhead surveys, research and management. 45
E1. Harris River, Prince of Wales Index Stream: AWC # 102-60-10820. 48
E2. Description and history of Harris River steelhead surveys, research and management. 49
F1. Eagle Creek, Prince of Wales Index Stream: AWC # 106-10-10300. 52
F2. Description and history of Eagle/Luck Creek steelhead surveys, research and management. 53
G1. Petersburg Creek, Petersburg Index Stream: AWC #106-44-10600. 56
G2. Description and history of Petersburg Creek steelhead surveys, research and management. 57
H1. Slippery Creek, Petersburg Index Stream: AWC # 109-43-10030. 60
H2. Description and history of Slippery Creek steelhead surveys, research and management. 61
I1. Ford Arm Creek, Sitka Index Stream: AWC # 113-73-10030. 64
I2. Description and history of Ford Arm Creek steelhead surveys, research and management. 65
J1. Sitkoh Creek, Sitka Index Stream: AWC # 113-59-10040. 68
J2. Description and history of Sitkoh Creek steelhead surveys, research and management. 69
K1. Pleasant Bay Creek, Juneau Index Stream: AWC # 111-12-10050. 72
K2. Description and history of Pleasant Bay Creek steelhead surveys, research and management. 73
L1. Peterson Creek, Juneau Index Stream: AWC # 111-50-10100. 76
L2. Description and history of Peterson Creek steelhead surveys. 77
M1. Data files used for analyses of this project and archived. 82

ABSTRACT

Snorkel surveys have been conducted annually since 1997 to monitor the spawning abundance of steelhead *Oncorhynchus mykiss* in 10 index streams in SEAK, and were conducted again during 2012 and 2013. These index streams were surveyed by a 2- or 3-person team using snorkel gear between mid-April and early June. Snorkel surveyors observed peak counts (counts bracketed by lower counts) in 8 of the index streams during 2012, and 7 during 2013. The 2012 counts show a slight decrease in numbers from the recent high years; however, in 2013 there was a slight increase.

Key words: steelhead, *Oncorhynchus mykiss*, emigration, abundance, Eagle Creek, Harris River, Humpback Creek, Ketchikan Creek, McDonald Lake Creek, White River, Slippery Creek, Petersburg Creek, Sitkoh Creek, Ford Arm Creek, Peterson Creek, Pleasant Bay Creek, Southeast Alaska, weir, sex, length, abundance indices, snorkel survey, index stream

INTRODUCTION

Southeast Alaska (SEAK) has at least 319 distinct watersheds known to support steelhead *Oncorhynchus mykiss* populations. Most populations are believed to contain 200 or fewer spawning adults. Major sport fisheries occur on several of the larger systems such as the Thorne River (Prince of Wales Island), which may support up to 1,000 spawning steelhead, and the Situk River, which has had annual returns of over 10,000 steelhead. Steelhead harvests in SEAK generally increased from the late 1970s through 1989 but then began to decline (Mills 1993). As fishery managers and anglers began reporting lower escapements, an emergency order (EO) prohibiting steelhead harvest in the Situk River was enacted in 1991. In 1992, harvests were prohibited by EO in 24 popular systems, and in 1993 steelhead harvest was again prohibited in the Situk River, along with 47 other systems. In 1994, the Alaska Board of Fisheries (BOF) enacted conservative regulations for steelhead across SEAK, thereby limiting anglers regionwide to a harvest of 2 steelhead per year with a minimum size limit of 36 inches (914 mm) total length (TL). In 1997, the BOF prohibited the use of bait year-round in 21 streams (and during the subsequent regulation drafting an additional 2 streams were added) with fall runs of steelhead providing additional protection to adult steelhead that overwinter in these systems prior to spawning. In 2009, the Alaska Board of Fisheries further restricted streams on the Juneau road system, as well as in high use streams, 24 fall steelhead systems, and Ward Creek, Thorne River, and Karta River in SEAK to non-retention of steelhead (5 AAC 47.023).

Intensive research on steelhead stocks in SEAK has largely been limited to Petersburg Creek (Jones 1972-1976), Situk River (Johnson 1990-1991, 1996; Didier and Marshall 1991; Johnson and Marshall 1991; Glynn 1992; Glynn and Elliott 1993; Bain et al. 2003; Johnson and Jones 1998-2001, 2003; Marston et al. 2012; Marston and Power 2016), and Sitkoh Creek (Love and Harding 2008-2009, Love et al. 2012a and 2012b). Estimates of migratory timing, abundance, and age composition have been made for a few other systems (Karta River: Jones 1983; Peterson Creek: Harding and Jones 1990-1992, Coyle and Reed 2012a, 2012b; and Sitkoh Creek: Jones et al. 1991, Yanusz 1997), whereas distribution patterns across individual watersheds was documented by multiple studies occurring between 2009-2012 (Crupi et al. 2010; Crupi and Nichols 2012a, 2012b; and Schroeder and Nichols 2012). Creel surveys of steelhead sport fisheries have also been conducted in SEAK (Klawock River: Freeman and Hoffman 1989-1991; Ward Creek: Hubartt 1989-1990; Karta River: Hoffman et al. 1990; Peterson Creek: Harding and Jones 1991, 1993-1994; Sitkoh Creek: Schmidt 1992), and run enhancement has been studied in 1 system (Ward Creek: Freeman 1992, 1995).

Although counts of adult steelhead have been conducted in a few select systems for many years, consistent foot surveys to monitor peak abundance were not initiated until 1994 by the Alaska Department of Fish and Game, Division of Sport Fish (DSF). Prior to 1998, survey methodology tended to be inconsistent across years and even systems, including monitoring different streams (Appendix B1) and reaches as observers gained experience in each system (Johnson and Jones 1998-2001; 2003; Harding 2005; Harding and Love 2008; Harding 2009). A map and narrative accounting for all of the past and current SEAK snorkel index systems is provided in Appendices C–M).

Substantial changes in survey methods were also instituted in 1997 to increase the proportion of steelhead observed in index streams and to better identify dates of peak instream abundance (Johnson and Jones 1998). Beginning in 1998, snorkeling became the standard method for conducting steelhead index surveys in alignment with the findings of Shardlow et al. (1987) that experienced snorkel surveyors generally observe the highest proportion of inriver steelhead among all common survey methods.

Snorkel surveys conducted in prioritized index systems have provided DSF with the ability to monitor trends in steelhead abundance across the region and across years. Initially this effort was implemented as a means of assessing the impact of conservative regulations enacted through the BOF process and EO's. Assuming harvests were reduced under the more conservative regulations and low populations have rebounded in the 20+ years since their inception, the steelhead snorkel survey program now simply gives the DSF an ability to monitor steelhead relative abundance in select systems deemed representative of all SEAK steelhead systems, which is consistent with other species stocks faced with unknown exploitation or more complex environmental impacts.

OBJECTIVE

During 2012 and 2013:

- Count the number of steelhead once a week from late-April through mid-May in 10 previously established SEAK index streams using standard snorkel techniques until a peak count is detected; in this context, a peak count is defined as the highest count occurring for an index system within a year, which is bracketed by smaller counts occurring in weeks before and after.

Associated tasks:

- Monitor stream temperatures in each of the index streams.

METHODS

SOUTHEAST ALASKA SNORKEL SURVEYS

Snorkel surveys were scheduled to provide indices of peak steelhead abundance for 10 streams in SEAK in 2012 and 2013 (Figure 1). The DSF Management areas for Ketchikan, Prince of Wales Island, Petersburg, Sitka, and Juneau each have 2 index streams. All index streams have been surveyed for steelhead since 1997 (Johnson and Jones 1998-2001, 2003; Harding 2005; Harding and Love 2008; Harding 2009) with the exceptions of Slippery Creek and Ward Creek. Slippery Creek has been surveyed during 11 years since 2000 (Slippery Creek was not surveyed in 2005 or 2013 due to budgetary restrictions), and Ward Creek has been surveyed 7 years since 1997. In

2013, McDonald Lake Creek was dropped as an index stream due to safety issues during this reporting period (2012-2013), and Ward Creek was reinstated as the second survey stream in the Ketchikan Management Area.

During this reporting period, reach area 4 on Eagle Creek was dropped due to safety concerns. In 2012 Slippery Creek (located approximately 40 air miles from Petersburg) was monitored but not during 2013 due to staffing constraints. McDonald Lake Creek in the Ketchikan Management Area was dropped as an index stream during 2013 after not being surveyed since 2008. McDonald Lake Creek is located approximately 50 miles from Ketchikan. Although McDonald Lake Creek is an important steelhead system, it is prone to high water conditions that make it very unsafe to survey, and conditions were often not known until staff arrived on site. Ward Creek, which is located on the Ketchikan road system and had been surveyed previously during 1997 and 1998 and then again from 2003–2005, was substituted in its staid. Other steelhead streams such as Ketchikan Creek have been surveyed in the past for management concerns but were not monitored during 2012 and 2013.

As in prior years, surveys of index streams were conducted weekly, up to 5 times (depending on the index stream), from late April through the end of May when instream abundance was expected to peak. A peak count is successfully achieved if it is bracketed by lower counts. If the highest count occurred during the last survey, an additional survey was attempted to obtain a bracketed peak count. In rare cases a final survey was not performed, so a final lower count was not obtained and the count was considered a “high” count.

Surveys were conducted by at least 2 observers wearing dry suits and snorkel gear. One trained senior observer was always present. Data from each survey in each stream were recorded for discrete sections (reaches) of the river (Appendix A1). When a shore-based (third) crewmember was available, counts were verbally conveyed to that person, whom tabulated and recorded the counts by reach as the survey progressed. When a shore-based crewmember was not available, one or both snorkelers recorded the counts by stream reach with a waterproof field notebook or something similar for later transcription onto conventional data forms.

Observers, as a team, counted all adult steelhead seen during the survey. The observers attempted to stay abreast of one another in the stream in order to coordinate their observations and obtain maximum coverage. When passing through high concentrations of steelhead, both observers counted the number of steelhead in their area of responsibility before consulting with each other and agreeing upon a final count for each reach area. If either or both surveyors felt that a questionable count was made in a particular stretch of river, the area was recounted. Typically, steelhead are minimally disturbed on the first pass, so accurate second counts of a pool or run are usually possible. The final survey count is a summary of each reach area count.

Several habitat and climactic variables were recorded at each survey site (Appendix A2 [2012] and A3 [2013]). Surface water temperature (°C) and weather conditions (cloud cover, wind, and precipitation) were recorded at the beginning of each survey. In each index system, water level heights relative to a permanent benchmark established in 1997 (except for Sitkoh and Ward Creeks) were recorded. This benchmark was either a permanent mark on a bridge abutment, a U.S. Geological Survey (USGS) gauging station, or a mark carved in bedrock. Water clarity was measured using a Secchi disk; the Secchi disk was held underwater by 1 observer approximately 20 cm below the water surface while the second snorkel observer would back away underwater, keeping visual contact with the disk, while feeding out the line. The point at which the Secchi

disk disappeared was the distance that was recorded. Observers in the Sitka management area also recorded the Secchi distance facing the sun and facing away from the sun.

Prior to 2012, reach area distances were estimated using topographic maps. During 2012 and 2013, reach area breaks were spatially identified via handheld Global Positioning System units and reach distances were calculated using a Geographic Information System (GIS).

The median trend line for steelhead counts in SEAK was first reported in Harding (2009) as an attempt to summarize the steelhead surveys from inception to present. Harding (2009) and Coyle (2012) included only the bracketed peak counts reported for index streams. Because of the switch from McDonald Lake Creek to Ward Creek and the removal of reach area 4 in Eagle Creek, and for consistency between years, the trend line counts during the 2012-2013 reporting period included those bracketed peak counts which meet the following criteria:

1. the stream surveyed is a currently monitored index stream;
2. the reach areas in the index stream are currently monitored (otherwise reaches no longer surveyed will be deleted from the bracketed peak count); and
3. the survey was complete (all designated reaches were surveyed by snorkeling only, and not by foot exclusively or a combination of foot and snorkel.

STREAM TEMPERATURE MONITORING

Temperature data loggers (HOBO temperature logger model U22 Pro v2)[1] were installed in 9 of the 10 snorkel index streams on the first survey of 2012 to provide information on temperature versus peak abundance (no temperature logger was installed in McDonald Lake Creek). The temperature loggers were scheduled to be retrieved each year during the first survey, at which time replacement loggers were installed. The temperature loggers were programmed to record and store temperatures every 2 hours.

RESULTS

SOUTHEAST ALASKA SNORKEL SURVEYS: 2012

Thirty snorkel surveys were conducted in the 10 steelhead index streams between April 24 and May 30, 2012 (Table 1, Appendix A2). Observers obtained a peak count in 8 of the index streams. Peak counts were obtained in all but the White River (a high count was obtained) and in McDonald Lake Creek (where no counts were performed due to budget constraints and safety issues). The peak 2012 steelhead counts ranged from 12 on May 17 in Peterson Creek to 125 on May 10 in Ford Arm Creek.

SOUTHEAST ALASKA SNORKEL SURVEYS: 2013

During 2013 McDonald Lake Creek was dropped as an index stream and replaced with Ward Creek on the Ketchikan road system due to safety concerns. Twenty-nine snorkel surveys were conducted on 9 of the 10 steelhead index streams between April 19 and June 7, 2013 (Table 2, Appendix A3). Slippery Creek in the Petersburg area was not surveyed during 2013 due to injury of the lead snorkeler in the management area and subsequent staffing constraints. Observers

[1] Product names used in this report are included for scientific completeness but do not constitute a product endorsement.

obtained a peak count in 7 of the index streams. The peak 2013 steelhead counts ranged from 29 on May 22 in Peterson Creek to 215 (without cabin hole) on May 9 in Petersburg Creek.

SOUTHEAST ALASKA SNORKEL SURVEYS: HISTORICAL EVALUATION OF MEDIAN TREND LINE AND INDEX COUNT

As in the 2008 and 2009 study period, the 2010, 2011 and 2012 counts show a slight decrease in numbers from the relatively recent high years (2004-2007); however, in 2013 there was a slight increase (Table 3). The recent index counts are still generally higher than the late 1990s counts. Recently, the median trend line for index counts in SEAK was slightly negative from 2010 through 2012, but in 2013 rose again (Figure 2). During 2012 both Pleasant Bay Creek and Harris River were above their median counts. Record high peak counts in southern SEAK index streams during 2013 (White River = 110 fish; Eagle Creek = 154) helped to drive the median trend line upwards. Peterson Creek on the Juneau road system also rebounded from the lowest peak count on record (12 steelhead in 2012) to a peak count of 29 steelhead in 2013.

STREAM TEMPERATURE MONITORING

Complete water temperature records during the 2012 surveys are available for White River, Eagle-Luck Creek, Slippery Creek, Petersburg Creek, Ford Arm Creek, Sitkoh Creek, Pleasant Bay Creek and Peterson Creek (Figure 3). No records are available for the Harris River or McDonald Lake Creek. In 2012, peak and high snorkel counts were recorded in index streams when the daily average water temperatures ranged from 3.7°C in Pleasant Bay Creek to 7.9°C in Petersburg Creek.

In 2013, peak and high snorkel counts were recorded in Petersburg Creek when the daily average water temperature was 8.9°C. A complete temperature record was collected at Slippery Creek, but no surveys were performed in 2013 due to personnel constraints. Partial temperature records were collected at Eagle Creek, Harris River, Ford Arm Creek, and Sitkoh Creek. These partial records are a result of the two-year reporting cycle; during 2014, the rest of temperature data will be collected when the HOBO data loggers are downloaded. No water temperature data was collected during 2013 at White River, Ward Creek (first year as index stream), Pleasant Bay Creek, and Peterson Creek (data logger was missing). New data loggers have been placed and replaced in all index streams for 2014. All 2013 temperature records available are similarly presented in Figure 3.

DISCUSSION

Steelhead snorkel survey counts in SEAK have been made since 1997 to monitor trends in steelhead abundance (Johnson and Jones 1998-2001, 2003; Harding 2005, 2008-2009, 2012; Coyle 2012). Snorkel surveys conducted in prioritized index systems have provided DSF with the ability to monitor trends in steelhead abundance across the region and across years in select systems deemed representative of all SEAK steelhead systems. This information continues to provide DSF managers and the BOF with the ability to refine regulations or management actions that otherwise would have to be made through nonexistent data or opinion. Survey year 2013 was the 17th season of this project. Eight of the systems have been monitored consistently since 1997 (White River, Eagle/Luck Creek, Harris River, Petersburg Creek, Ford Arm Creek, Sitkoh Creek, Pleasant Bay Creek, and Peterson Creek) (Appendix B1). Five of the 7 DSF Management Areas in SEAK have 2 steelhead index streams each (Ketchikan, Prince of Wales, Petersburg,

Sitka, and Juneau). Yakutat has a steelhead weir on the Situk River and the Haines/Skagway area has no steelhead index streams. Index streams were selected during 1990's by DSF staff for their management interest and ease of access (Roger Harding, retired Sport Fish Fisheries Biologist, personal communication). Various steelhead index streams during the first few years of the surveys were dropped as DSF staff evaluated their utility. Both Humpback Creek and Marten Creek were dropped in 2000 due to erratic counts at Humpback Creek (4-91) and persistently low counts at Marten Creek (14-18) (Johnson and Jones 2001). Slippery Creek was added in 2000, replacing Marten Creek as the second Petersburg area index stream.

Over the duration of this project (prior to and including 2012 and 2013), more consistent bracketed peak counts have been achieved by area management staff surveying index streams. From 1997–2006 an average of 4 bracketed peak counts was achieved per season ranging from 2 to 6 bracketed peaks per season, whereas from 2007–2013 an average of 8 bracketed peak counts per season were achieved ranging from 6 to 9. Eight bracketed high peaks were obtained in 2012 and 7 were obtained in 2013.

Reviewing the bracketed peak and high survey counts for index streams in all years reveals that the 2012-2013 counts were generally higher than the 2010-2011 reporting period, and observers reported median to above median peak counts in 4 of 9 index systems in 2012 (Ward Creek was not surveyed this year) and in 6 of 9 systems in 2013 (Slippery Creek was not surveyed this year) (Figure 2). Bracketed peak counts were obtained for 8 of 10 index systems in 2012, and bracketed peak counts were obtained for 7 of 9 index streams in 2013 (Slippery Creek was not surveyed during 2013 due to staffing constraints). A record low count was recorded for Peterson Creek during 2012 (12 fish vs. median count of 26 fish), and record high peak counts were recorded for both the White River (110 fish vs. median count of 45 fish) and Eagle Creek (154 fish vs. median count of 82 fish) during 2013.

During this reporting period, index counts at Petersburg Creek, Sitkoh Creek, Ford Arm Creek, and Peterson Creek trended downward, compared to the long-term median. Downward trends at these steelhead streams should be monitored by mangers, perhaps especially for Peterson Creek in Juneau and Sitkoh Creek on Chichagof Island because they displayed the steepest downward trends. Peterson Creek is a small run surrounded by the largest community in SEAK with road access, and Sitkoh Creek appears to have the steepest decline in bracketed peak counts (Table 3).

Of the 10 index streams, Peterson Creek has the lowest abundance, and ranks 9th in density (steelhead/km of stream surveyed), followed closely by the White River, which ranks 9th and 10th in median abundance and density (Appendix A1). Steelhead counts at the Peterson Creek weir, from 1989 to 1991, averaged 205 fish. Two decades later the counts at the Peterson Creek weir averaged 124 fish across 2010 and 2011, which is nearly a 60% decrease. No snorkel index counts are available for Peterson Creek during the 1989–1991 timeframe from which to compare to both the weir (census) count then and again in 2010–2011. What the median trend line does suggest, however, is that despite 2010–2011 counts being 60% of what they were in 1989–1991, the peak snorkel counts for the same years in Peterson Creek were actually higher than the median count, representative of 1997–2013, by 35% and 4% respectively for 2010 and 2011.

Peterson mark–recapture estimates at Sitkoh Creek weir from 2003–2009 ranged from a high of 780 to a low of 480 adult steelhead (Love et al. 2012b), and ranked 4th in terms of both density and median abundance of the 10 index streams (Appendix A1). Love et al. (2012b) noted that extreme flows during the fall of 2005 probably affected freshwater survival of smolt from Sitkoh

and thus resulted in lower subsequent adult returns. Bracketed peak counts at Sitkoh Creek in 2012 and 2013 are still much lower than counts from 2003–2005, which follows regional trends in steelhead production in SEAK; such lowered freshwater survival could be compounded with lowered marine survival during these years.

Trends in production of anadromous fish such as steelhead are regulated by both freshwater production and marine production factors such as suitable spawning and rearing habitat, water/sea temperature, freshwater flooding, snowpack, prey availability, and energy content of prey, as well as competition for these resources. In light of low smolt to spawner ratios observed in a multiyear study at Sitkoh Creek, Love et al. (2012b) posit that steelhead production in these small streams in SEAK is sustained by a higher incidence of repeat spawning (11-70%) by older, highly fecund females than has been observed in larger rivers to the south of Alaska. Love et al. (2012b) also noted that stable suitable habitat and lack of flooding or other extreme abiotic events are critical to freshwater survival.

The average daily freshwater temperatures during peak snorkel counts for the two-year reporting period ranged from 3.06°C (Slippery Creek) during 2012 to 7.65°C (Petersburg Creek) during 2013 (Table 4). Although robust inferences from the temperature data are not possible given study design constraints, it does provide some baseline water temperature data for steelhead streams in SEAK. Such data may become important if significant climate changes alter the timing of peak spawning activity because of the close relationship between snowpack, water levels, and water temperatures, all of which could be affected.

Steelhead peak immigration was, in general, slightly later in 2012 than 2013, continuing a trend observed between 2011 and 2010 (2011 peak immigration occurring later than 2010); only the 2 systems in the Sitka area (Ford Arm Creek, Sitkoh Creek) displayed earlier peak immigration in 2012 compared to 2013. Again speaking in general terms, there appeared to be a trend for later immigration for southern systems (White River, Harris River, Eagle/Luck Creek, Petersburg Creek) than for central (Sitka Area streams) or northern systems (Pleasant Bay Creek, Peterson Creek).

By the beginning of this project period (2012), more than 17 years had elapsed since the implementation of stricter regulations in 1994, and the response of steelhead stocks in these 10 index systems has been mixed. With the exception of 2001, snorkel index counts were, on average, lower between 1999 and 2003 than those previous or since, up to about 2011 (Figure 2). Beginning in 2004 and continuing through 2007, snorkel counts trended upwards but declined to average or below average during 2008 and 2009 and continued to decline slightly each year in 2010 and 2011, continuing in 2012. Even though index stocks rebounded to above-average levels in 2013, it remains unclear whether these stocks have rebounded from the depressed levels observed in the late 1980s and early 1990s, leading to the department's decision to issue emergency orders closing many streams to the retention of steelhead in 1992 and again in 1993. Of the 10 currently used index systems, three have shown strong decreasing trends relative to the median trend line: Sitkoh Creek snorkel counts between 2011–2013 averaged less than 60% of the median, Ford Arm Creek snorkel counts between 2010–2013 averaged less than 22% of the median, and Petersburg Creek snorkel counts for the same time frame averaged less than 18% of the median. Of those three systems, only Petersburg Creek had a single year experience at least one snorkel count above the long-term median (2010: 7% above; 2013: 4% above). In contrast, only 2 systems experienced two consecutive years of above-median snorkel counts between 2010–2013: Eagle Creek in 2012 and 2013 (26% above) and Pleasant Bay Creek in 2011 and

2012 (53% above). All other systems varied between above-median and below-median snorkel counts during the same time frame.

Because nearly all steelhead systems (including all 10 index systems) in Southeast Alaska are composed of small populations (average <200 fish, and most average <100 annually), with only a handful monitored, managers will continue to be challenged as they are charged with ensuring these stocks persist, especially with potentially more significant ecological regime shifts or the effects due to climate change.

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TABLES AND FIGURES

Table 1.–Steelhead index streams surveyed in 2012 along with dates of peak (P; bracketed) or high (H; unbracketed) counts.

Stream name	No. of surveys	Date of peak or high count	Water temp (°C) on date of peak or high date	Steelhead count	Type of count	General location
White River	3	5/01/2012	4.1	73	(H)	Ketchikan, Revillagigedo Island
McDonald Lake Creek	0	ND	ND	ND	(ND)	Ketchikan, Southern mainland
Harris River	3	5/03/2012	ND	84	(P)	Prince of Wales Island
Eagle/Luck Creek	4	5/23/2012	7.3	116	(P)	Prince of Wales Island
Petersburg Creek	5	5/17/2012	7.9	95	(P)	Petersburg, Kupreanof Island
Slippery Creek	3	5/14/2012	6.1	83	(P)	Petersburg, Kuiu Island
Ford Arm Creek	3	5/10/2012	4.6	125	(P)	Chichagof Island
Sitkoh Creek	3	5/18/2012	5.8	69	(P)	Chichagof Island
Pleasant Bay Creek	3	5/15/2012	3.7	76	(P)	Juneau, Admiralty Island
Peterson Creek	3	5/17/2012	4.0	12	(P)	Juneau, Northern mainland

Table 2.–Steelhead index streams surveyed in 2013 along with dates of peak (P; bracketed) or high (H; unbracketed) counts.

Stream name	No. of surveys	Date of peak or high count	Water temp (°C) on date of peak or high date	Steelhead count	Type of count	General location
White River	3	4/23/2013	ND	110	(P)	Ketchikan, Revillagigedo Island
Ward Creek	3	4/25/2013	ND	34	(H)	Ketchikan, Southern mainland
Harris River	3	4/23/2013	ND	166	(P)	Prince of Wales Island
Eagle/Luck Creek	4	5/07/2013	ND	154	(P)	Prince of Wales Island
Petersburg Creek	3	5/9/2013	8.9	215	(P)	Petersburg, Kupreanof Island
Slippery Creek	0	ND	ND	ND	ND	Petersburg, Kuiu Island
Ford Arm Creek	4	5/16/2013	ND	154	(P)	Chichagof Island
Sitkoh Creek	3	5/23/2013	ND	99	(P)	Chichagof Island
Pleasant Bay Creek	2	5/8/2013	8.9	215	(H)	Juneau, Admiralty Island
Peterson Creek	4	5/22/2013	ND	29	(P)	Juneau, Northern mainland

Table 3.–Steelhead snorkel survey counts collected on current and past index streams in Southeast Alaska, 1997–2013.

Management area	Stream Name	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Ketchikan	White River	84	93[a]	60	38[a]	48[a]	37[a]	77[a]	35	67	41[a]	85[a]	45[a]	45[a]	42[a]	47[a]	73	110[a]
	Ward Creek	10	41	-[b]	-[b]	-[b]	-[b]	143	171	146	-[b]	-[b]	-[b]	-[b]	-[b]	-[b]	-[b]	35
PWI	Harris River	104	156[a]	192[a]	79[a]	53	188	195	124[a]	123[a]	92[a]	128[a]	122	90[a]	95[a]	58	84[a]	166[a]
	Eagle Creek[b]	90	35[a]	107	82[a]	-[b]	36[a]	75	45	92	124	134	5	107[a]	49[a]	54	116[a]	154[a]
Petersburg	Petersburg Creek	123	152[a]	115[a]	42	64	41	188[a]	330[a]	369[a]	241[a]	289[a]	251[a]	198[a]	221[a]	131[a]	112[a]	215[a]
	Slippery Creek	-[b]	-[b]	-[b]	33	41	31	76	92[a]	-[b]	79	68[a]	46[a]	86[a]	66[a]	52[a]	83[a]	-[b]
Sitka	Ford Arm Creek	296	103	89	134[a]	28	122	181[a]	379[a]	459[a]	428[a]	673[a]	266[a]	194[a]	99[a]	169[a]	125[a]	154[a]
	Sitkoh Creek	329	154	120	112	115	65	296[a]	354[a]	259[a]	213[a]	70	167[a]	201[a]	71	68[a]	69[a]	99[a]
Juneau	Pleasant Bay Creek[d]	139	77[a]	130	48[a]	48	36[a]	50[a]	51[a]	47	59	94[a]	53[a]	64[a]	51[a]	94[a]	76[a]	77
	Peterson Creek	26[a]	29	38	27	41[a]	13[a]	36[a]	39	22[a]	36[a]	26[a]	26[a]	22[a]	35[a]	27[a]	12[a]	29[a]

Note: High counts are included but should be viewed with caution. Often they represent incomplete counts (not all reaches were surveyed), single surveys, and years where the survey reaches changed.

[a] Indicates a bracket peak count was attained; all others where a survey was performed attained only a high count.

[b] No snorkel surveys were conducted in this system and year.

[c] Because Reach 4 on Eagle Creek was removed, these counts have had the steelhead counted in Reach 4 removed and may differ slightly from those counts previously published. Overall very few steelhead were counted in Reach 4 and it was skipped many times due to high water and the dangerous nature of this reach. Peak/high counts during 1999, 1998, 2003, 2006, 2008, 2009, and 2010 were affected (only the survey count in 2006 became a high count as a result and was removed from the regional trend line depicted in Figure 3).

[d] From 1997 though 1999, Pleasant Bay Creek counts were for 3 reach areas; Reach Area 3 was dropped in 2000. These counts have had Reach Area 3 counts removed.

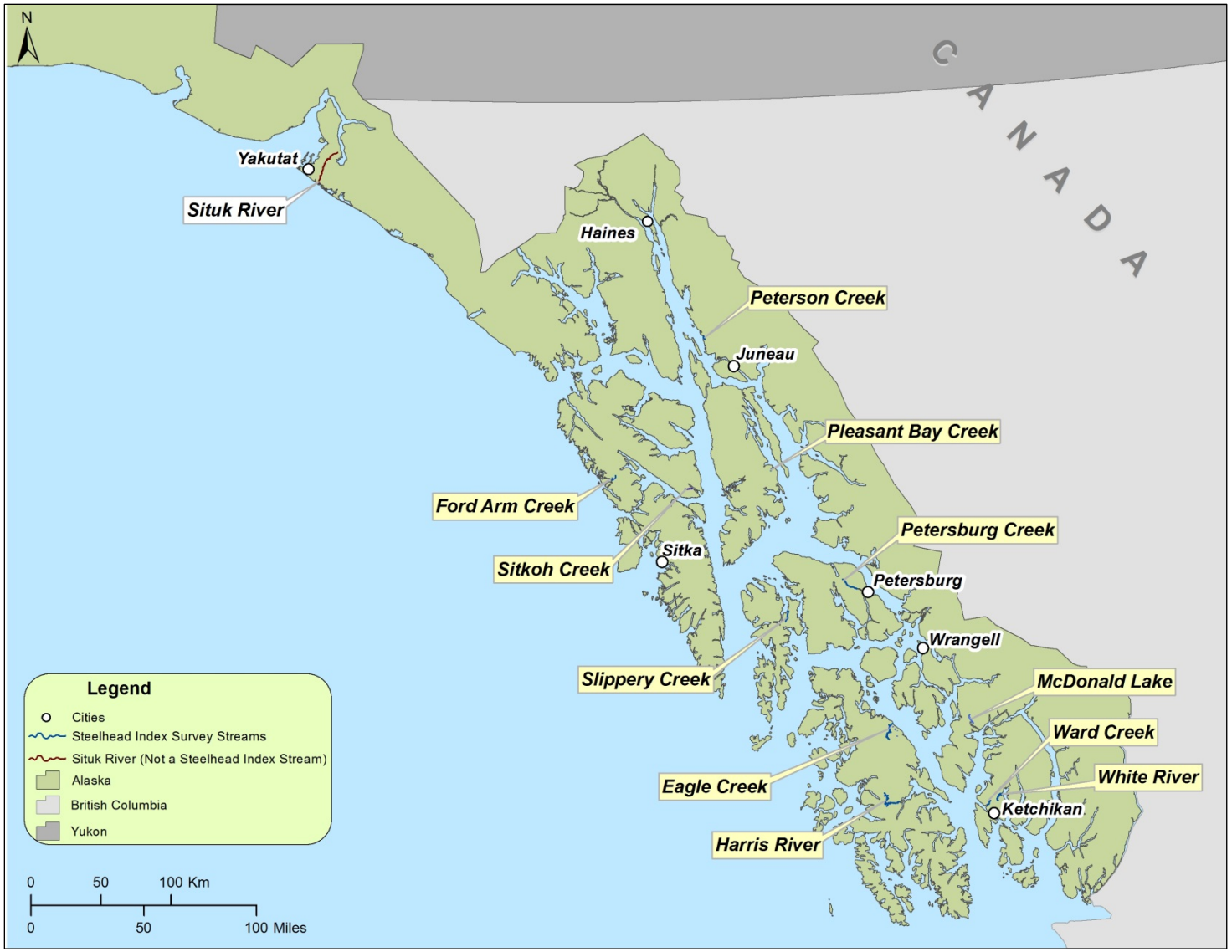

Figure 1.–Locations of the Situk River and the steelhead index systems in Southeast Alaska surveyed in 2012 and 2013.

Note: Ward Creek replaced McDonald Lake as an index stream in the Ketchikan Management Area in 2013.

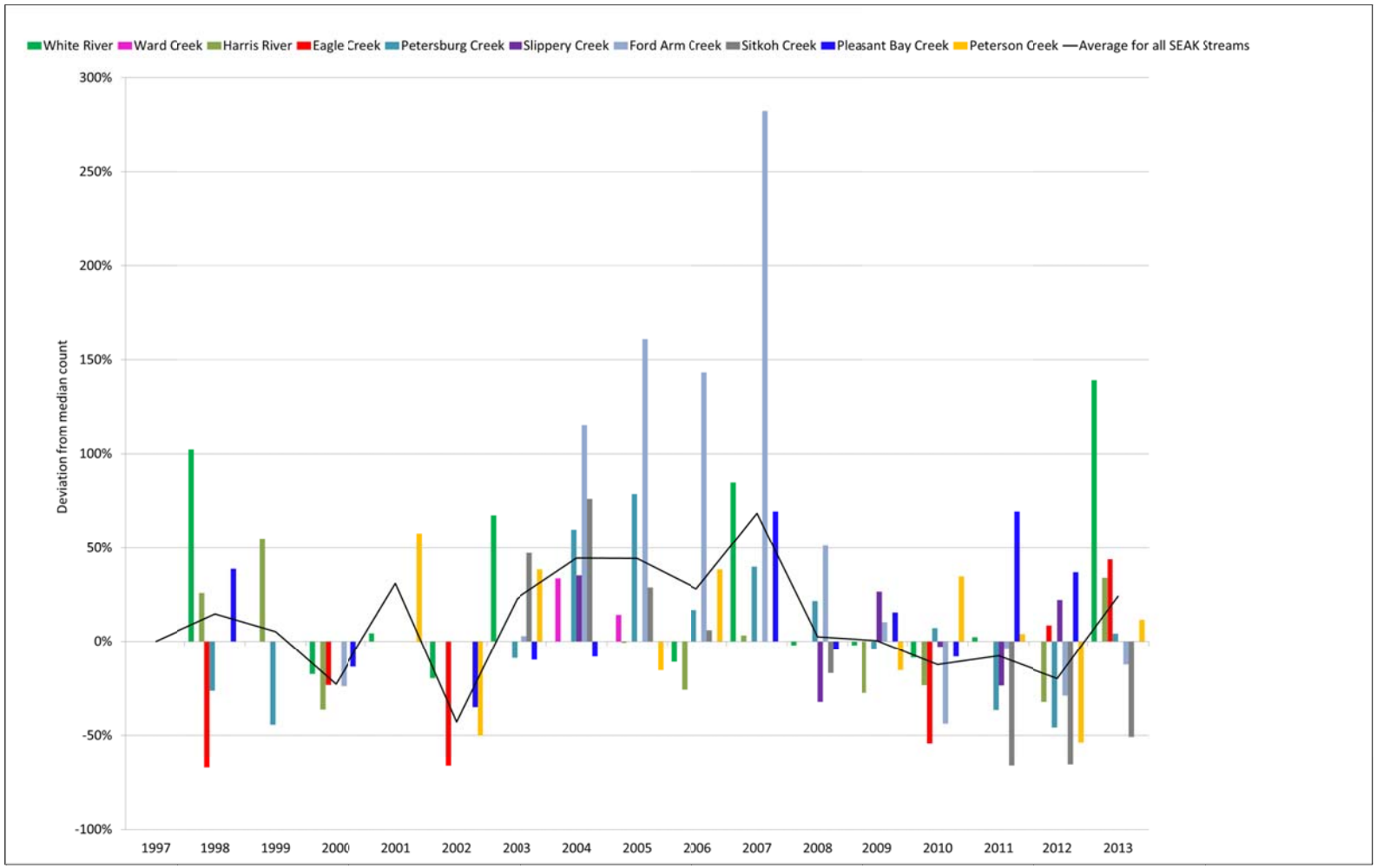

Figure 2.–Annual deviations from the median peak snorkel survey count (bars) and the average annual deviation (line) for Southeast Alaska steelhead snorkel surveys, 1997-2013.

Note: Only peak counts were used and only for systems surveyed since 1997 with the following criteria: 1) the stream surveyed is a current index survey stream; 2) the reach areas in the index stream are currently monitored (otherwise reaches no longer surveyed will be deleted from the bracketed peak count); and 3) the survey was complete (all designated reaches were surveyed by snorkeling, not by foot or combination). The bracketed peak counts for all years reflect only the reaches currently surveyed for comparison purposes and may be different from those published by Harding (2009) and Coyle (2012).

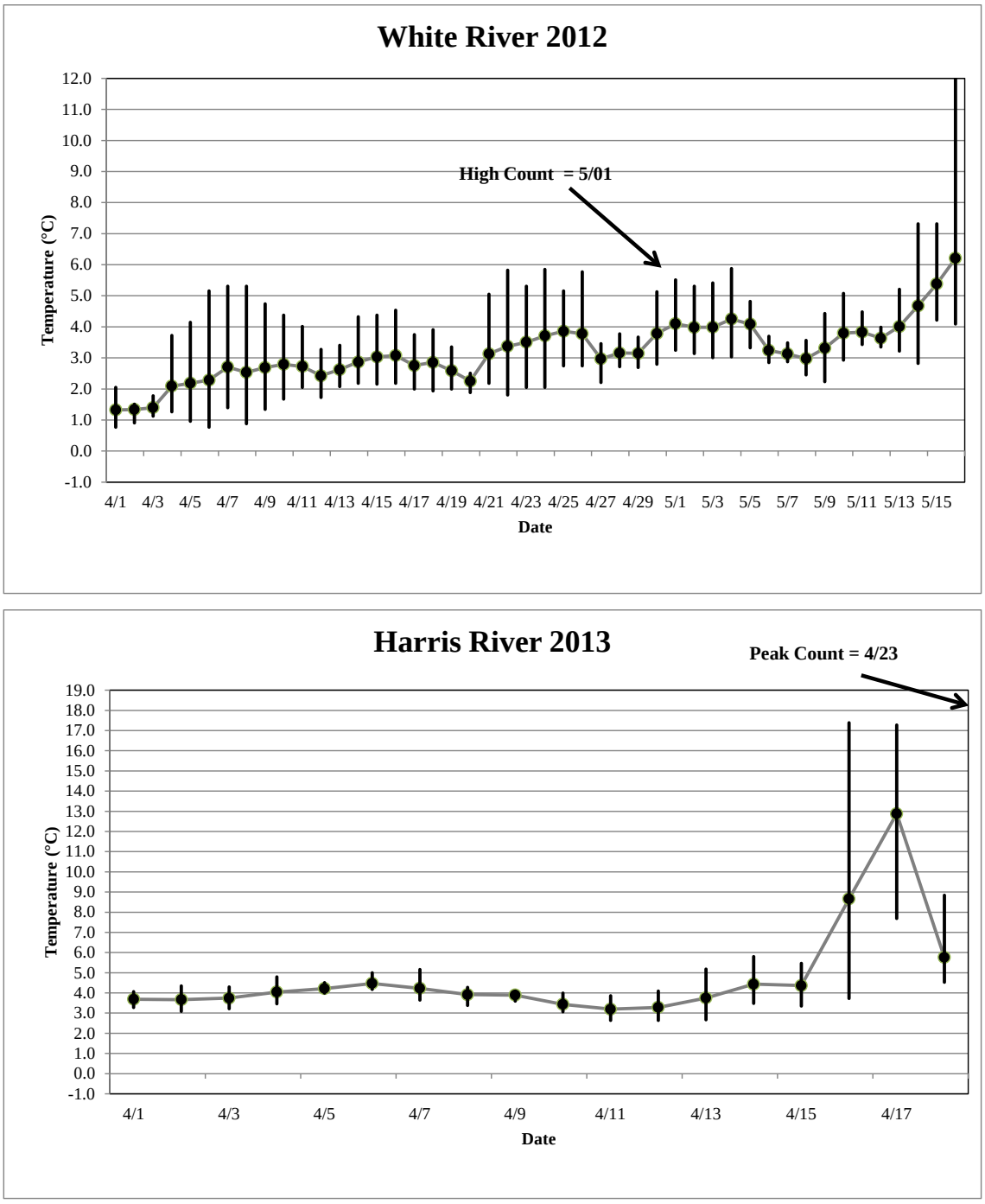

Figure 3.–The daily high, low, and average water temperatures recorded at steelhead index streams and the dates of "high" or "peak" snorkel counts during the 2012 and 2013 Southeast Alaska steelhead snorkel surveys.

Note: No temperature graphs exist for McDonald Lake Creek 2012 and 2013, White River 2013, Harris River 2012, Pleasant Bay Creek 2013, and Peterson Creek 2013.

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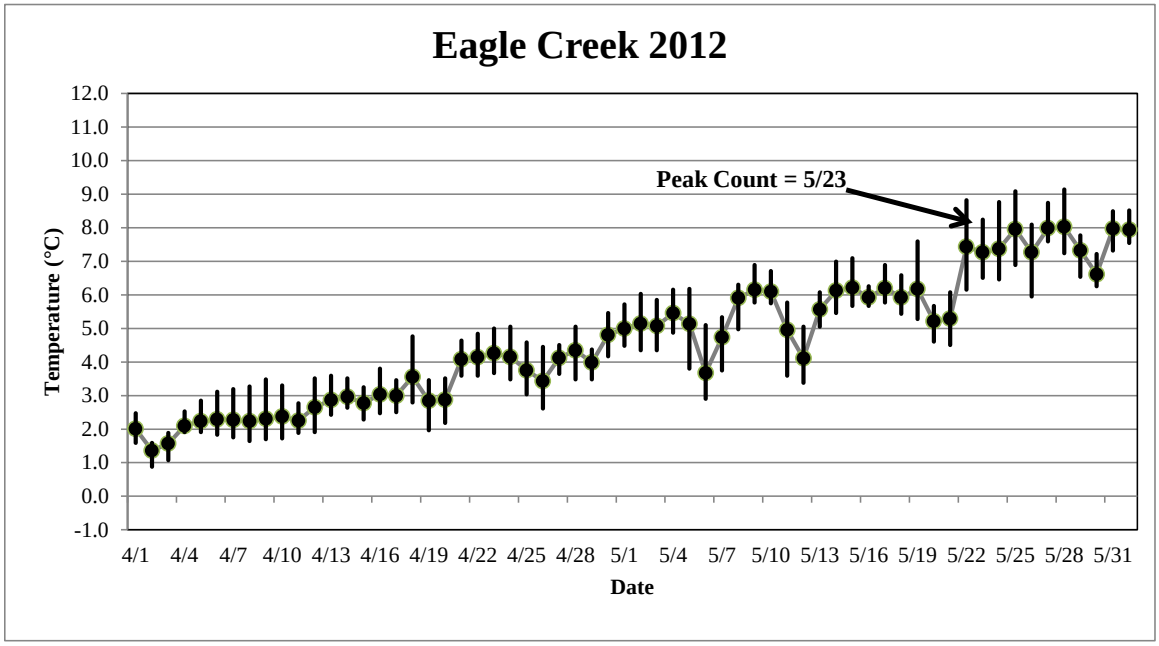
Figure 3.–Page 2 of 7.



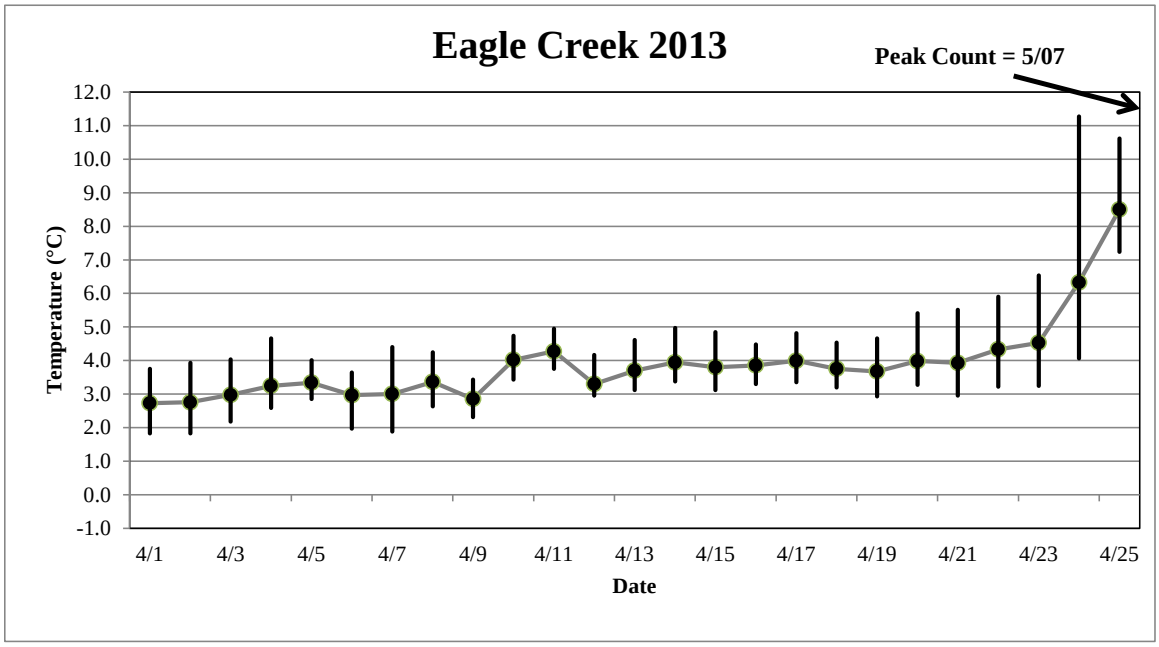


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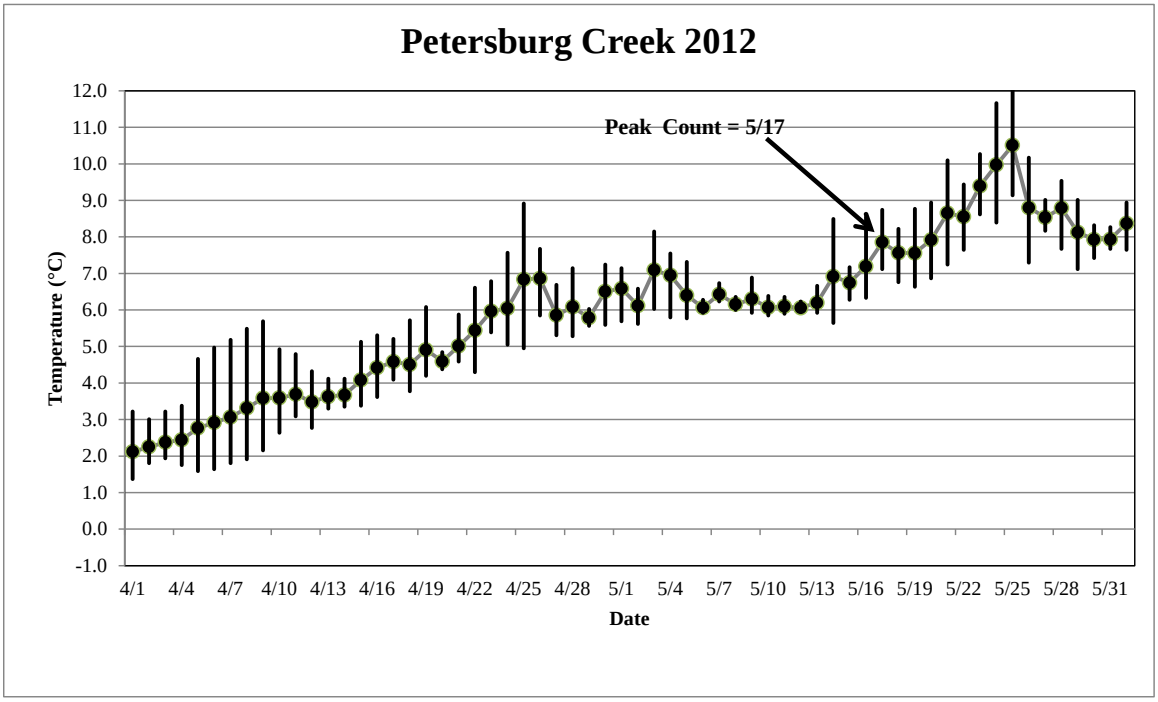
Figure 3.–Page 3 of 7.



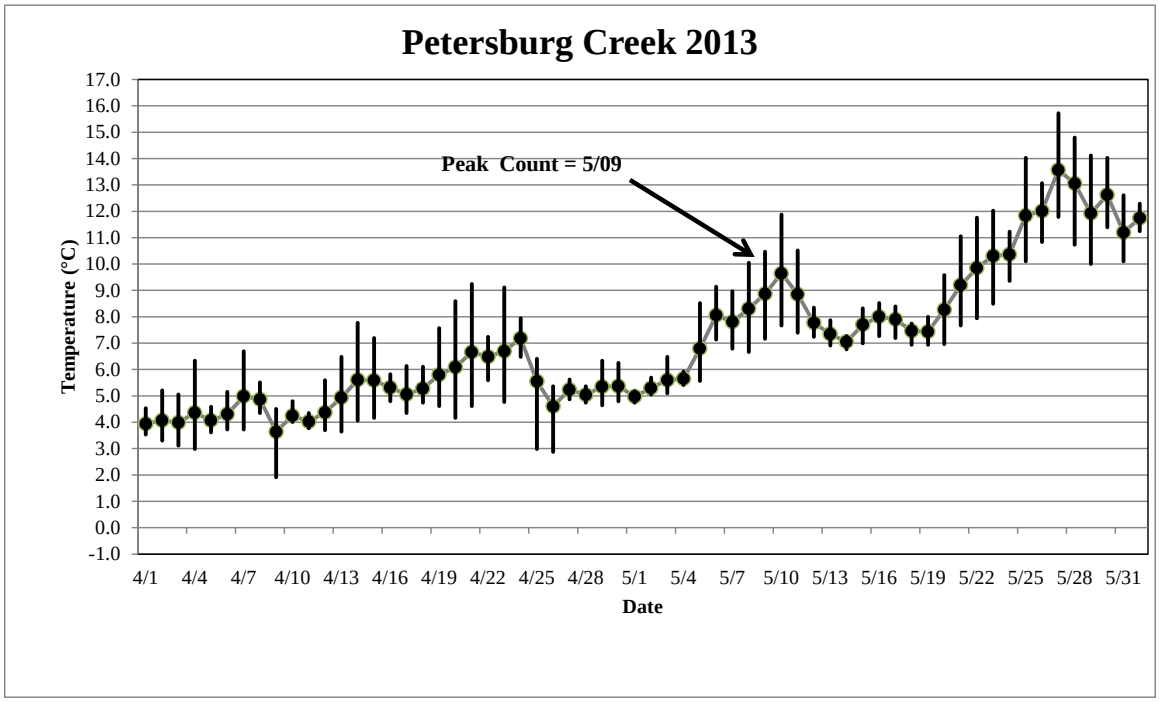


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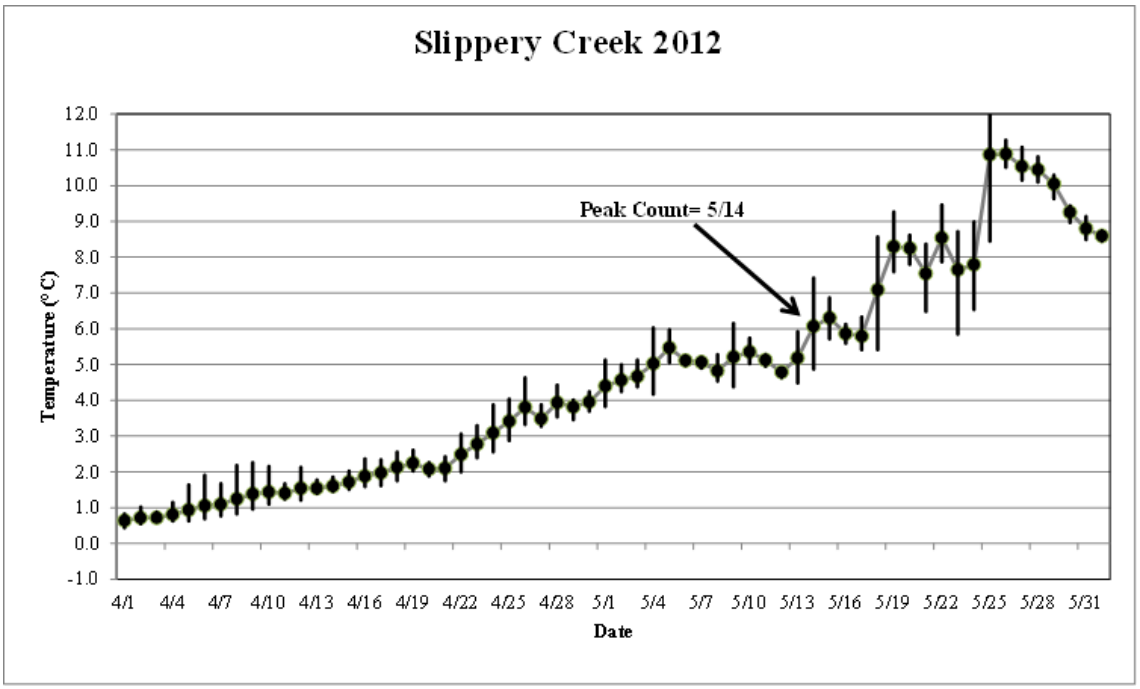
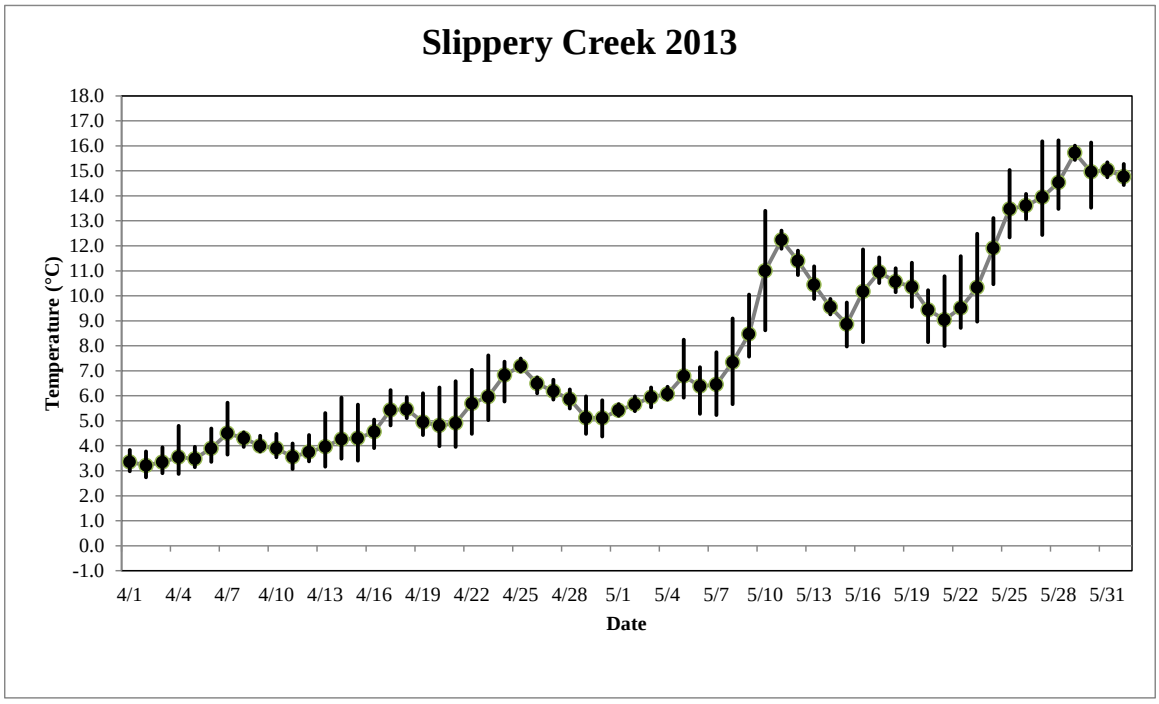
Figure 3.–Page 4 of 7.





Note: Slippery Creek was not surveyed in 2013, and therefore there is no peak count plotted.

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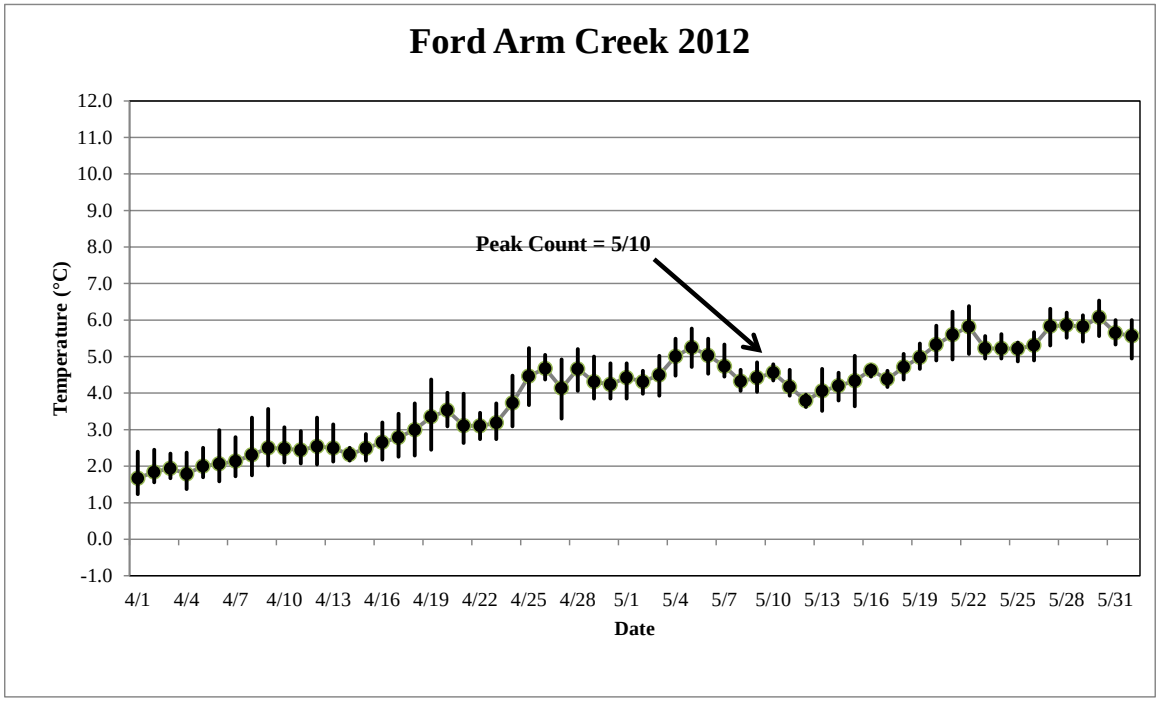
Figure 3.–Page 5 of 7.



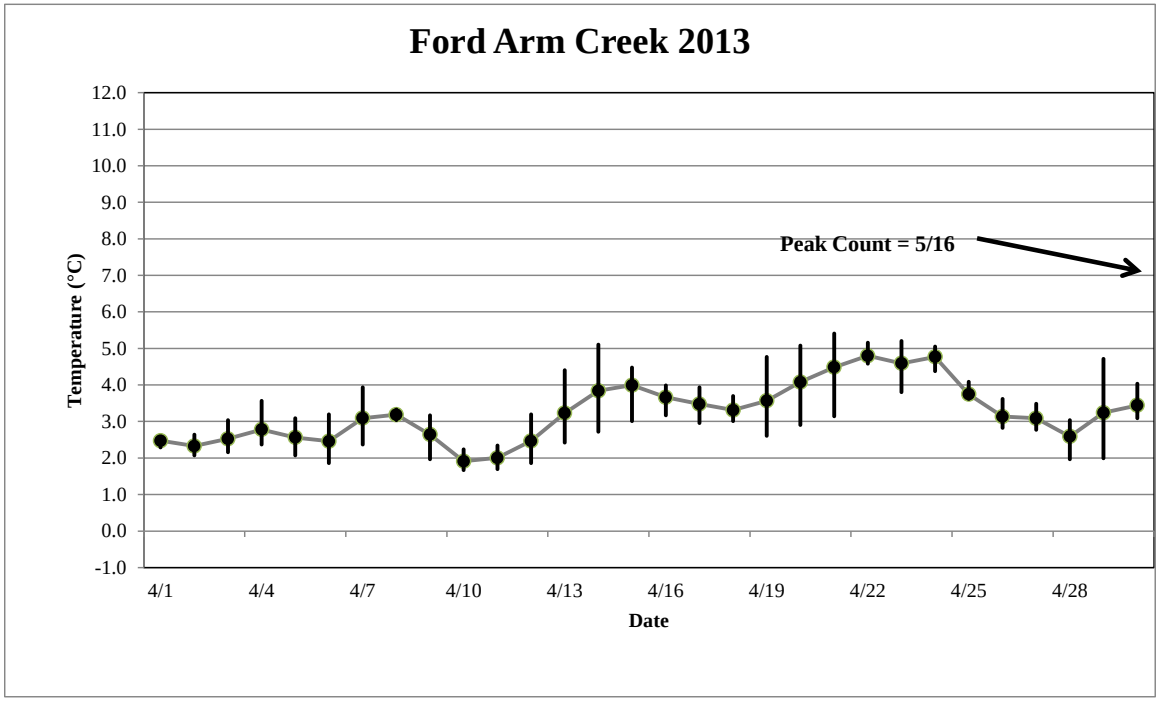


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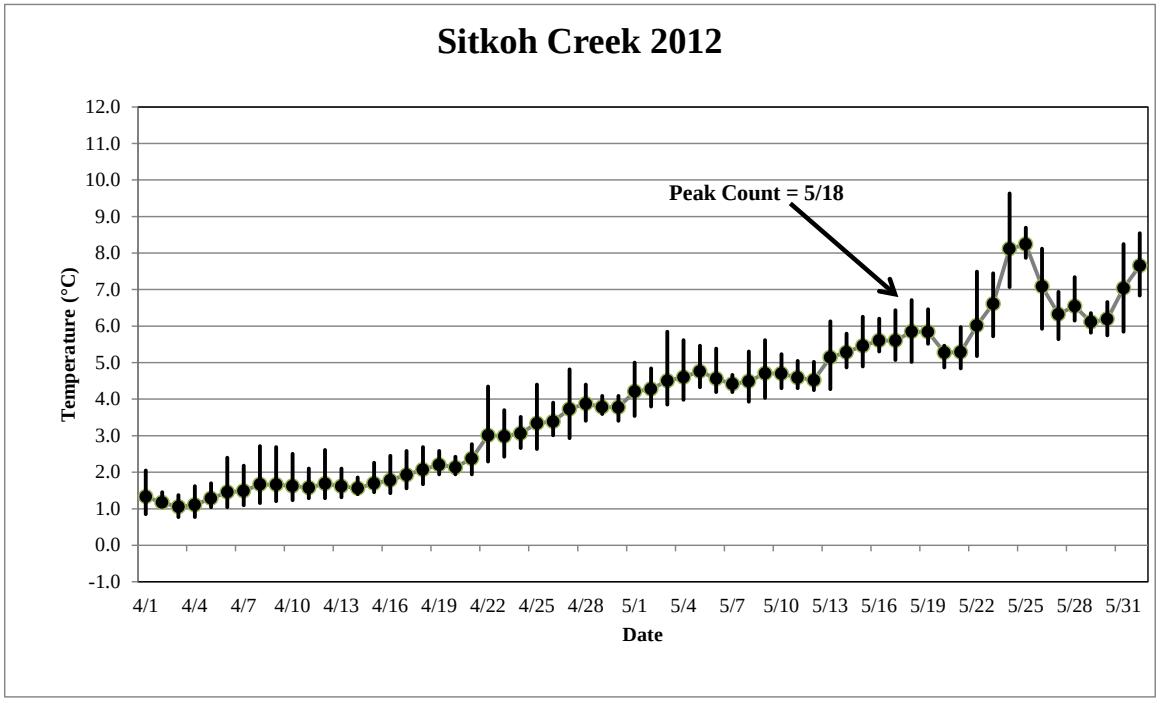
Figure 3.–Page 6 of 7.



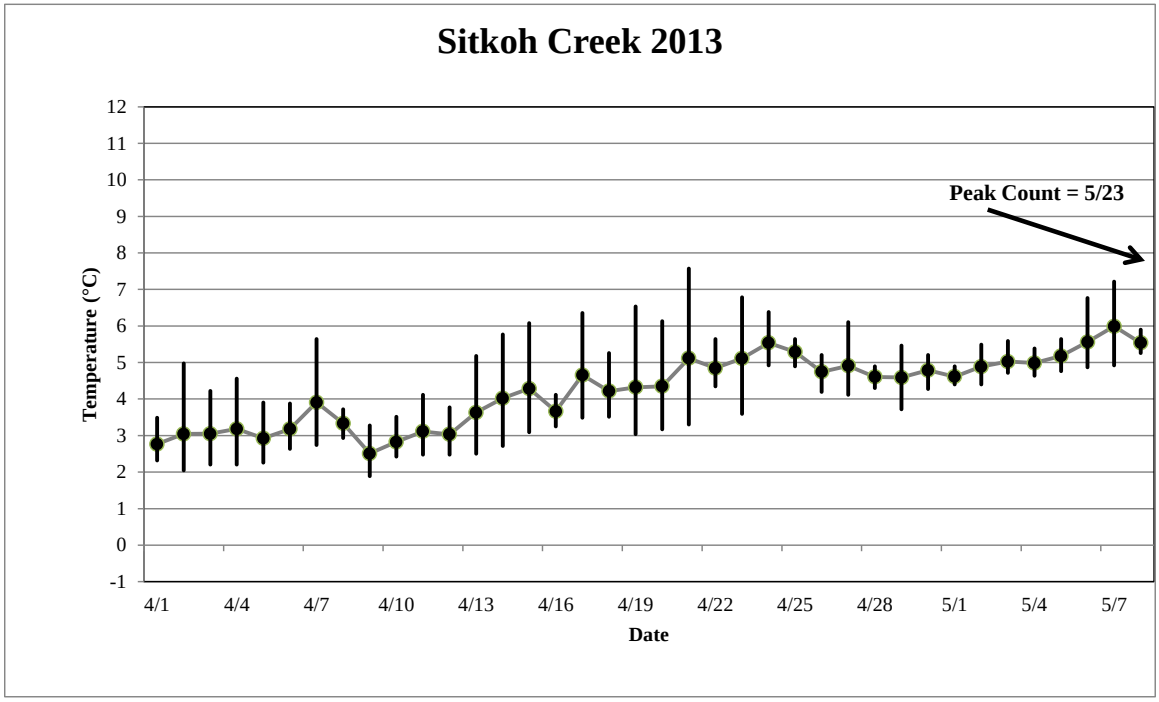


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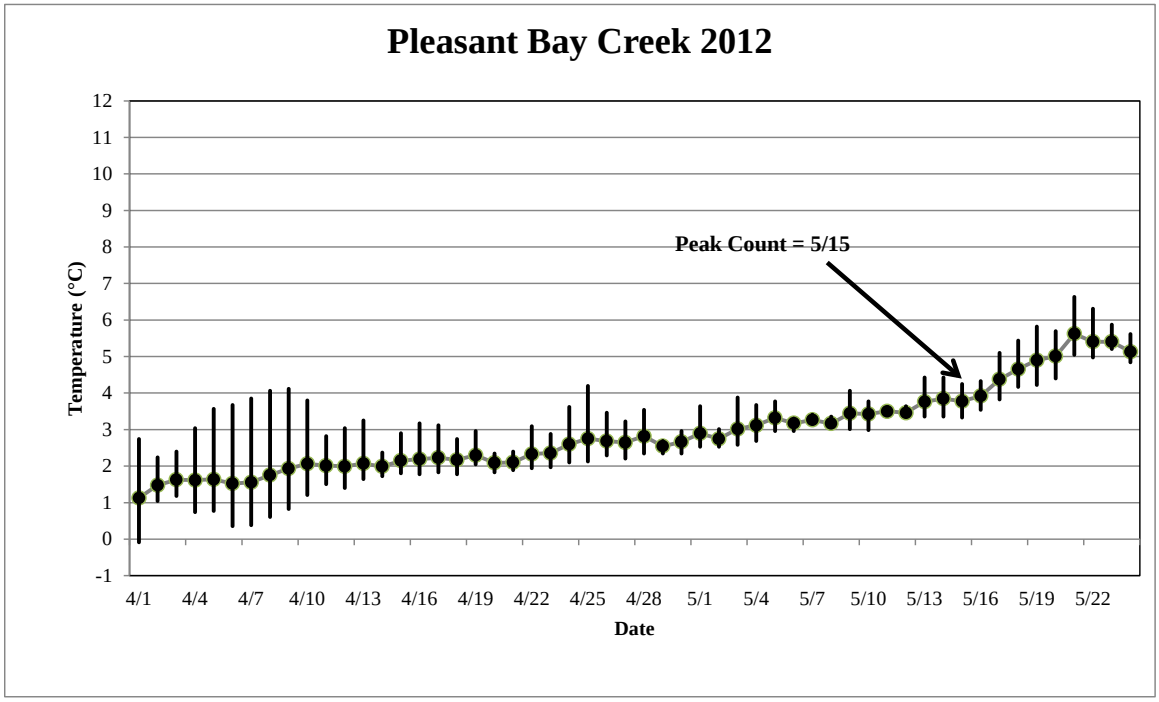
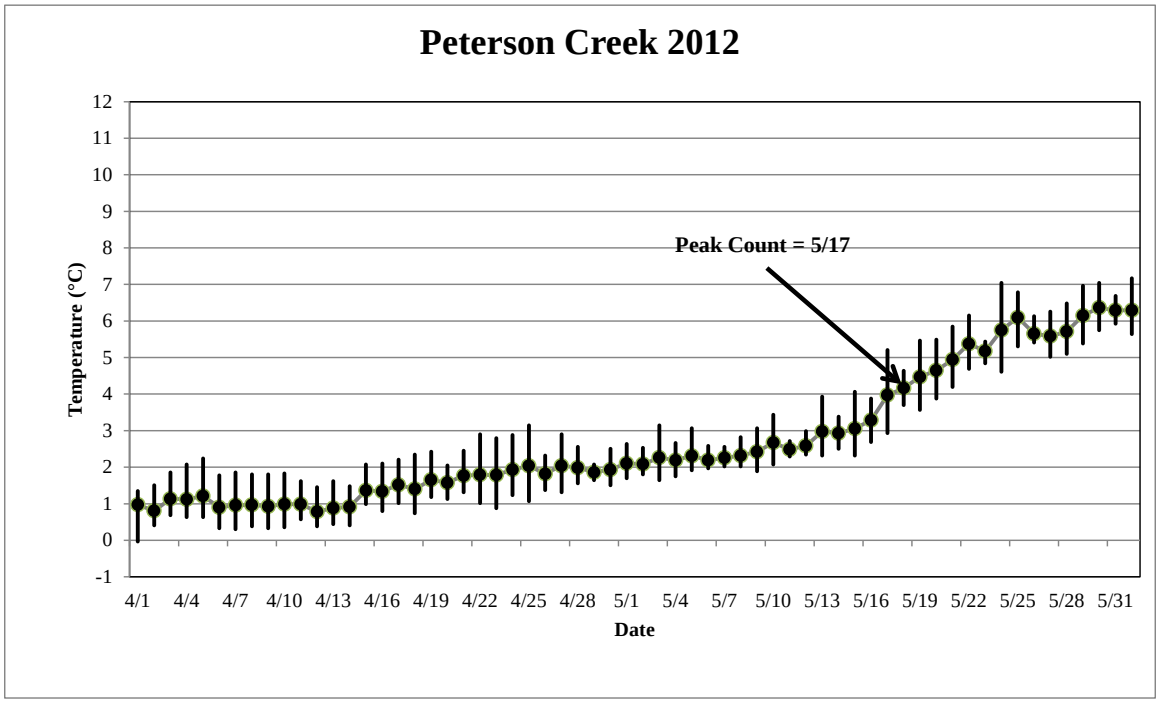
Figure 3.–Page 7 of 7.





APPENDIX A: STEELHEAD COUNTS 2012–2013

Appendix A1.–Steelhead index stream name, anadromous stream number, management area, length and percent of stream surveyed, number of survey reaches, and approximate dates for start of weekly surveys for steelhead in 2012 and 2013.

Index stream	Anadromous stream number	Survey length / stream length[a] (km)	% of stream surveyed	Median count as of 2013	Density[b] (steelhead/km) using median count as of 2013	Number of reaches	Target survey date
White River	101-44-10024	5.213 / 8.716	59.8	45	8.63	3	25-Apr
Harris River	102-60-10820	10.880 / 21.631	50.3	122	11.21	5	24-Apr
Peterson Creek	111-50-10010	1.484 / 2.680	55.4	26	17.52	1	30-Apr
Eagle/Luck Creek	107-40-10055	4.494 / 12.041	37.3	82	18.25	3[c]	23-Apr
Pleasant Bay Creek	111-12-10005	2.408 / 2.558	94.1	58	24.09	2[e]	30-Apr
Slippery Creek	109-43-10030	2.453 / 8.755	28.0	67	27.31	2[d]	30-Apr
Sitkoh	113-59-10004	5.940 / 6.124	97.0	184	30.98	3	30-Apr
Petersburg Creek	106-44-10600	5.348 / 13.427	39.8	241	41.06	3	30-Apr
Ward Creek	101-47-10150	3.208 / 5.756	55.7	158	49.25	3	23-Apr
Ford Arm Creek	113-73-10030	1.437 / 2.736	52.5	188	130.83	2	30-Apr

[a] Survey length reflects the total length of all reaches for a particular stream that were surveyed by snorkel; stream length reflects the total anadromous extent of the stream.

[b] Density calculated as the number of steelhead counted only in surveyed reaches divided by the linear extent (km).

[c] Reach area 4 was dropped in 2012 due to safety concerns in Eagle Creek.

[d] Reach area 3 of Slippery Creek was dropped in 2006 due to safety concerns.

[e] Reach area 3 was dropped in 2000 due to safety concerns, and because <10% of steelhead were ever observed in this section of river in Pleasant Bay Creek..

Appendix A2.–Counts of steelhead from 2012 surveys by date, stream, and reach of stream along with measured environmental variables.

Stream	Survey date	Survey reach	Observers[a]	Survey type[b]	Reach distance surveyed (m)[c]	Tide code[d]	VIS code[e]	Water level code[f]	Weather code[g]	Staff gauge level (cm)	Secchi disk (m)[h]	Surface water temp. (°C)	Number of live steelhead
Harris	4/24	1	KP,MW	S	438	ND	21	32	C	ND	7.62	5.0	4
Harris	4/24	2	KP,MW	S	3,640	ND	21	32	C	ND	7.62	5.0	61
Harris	4/24	3	PF,TT	S	3,236	ND	21	32	C	ND	7.62	5.0	10
Harris	4/24	4	PF,TT	S	2,984	ND	21	32	C	ND	7.62	5.0	0
Harris	4/24	5	PF,TT	S	582	ND	21	32	C	ND	7.62	5.0	0
Eagle/Luck	4/25	1	KP,MW	S	1,279	ND	22	32	C,O	ND	3.66	5.0	12
Eagle/Luck	4/25	2	KP,MW	S	1,796	ND	22	32	C,O	ND	3.66	5.0	12
Eagle/Luck	4/25	3	PF,TT	S	1,419	ND	22	32	C,O	ND	3.66	5.0	63
Eagle/Luck	4/25	4[i]	PF,TT	S	1,221	ND	22	32	C,O	ND	3.66	5.0	0[i]
Petersburg	5/1	1	DF, VG	S	1,483	ND	22	32	O	-70.00	5.80	4.5	20
Petersburg	5/1	2	DF, VG	S	2,003	ND	22	33	O	-70.00	5.80	4.5	30
Petersburg	5/1	3	DF, VG	S	1,862	ND	22	33	O	-70.00	5.80	4.5	11
Petersburg	5/1	4[j]	DF, VG	S,B	–[j]	42	22	33	O	-70.00	5.80	4.5	24[j]
White River	5/1	1	KP,MW	S	2,815	ND	22	31	O	ND	ND	5.0	41
White River	5/1	2	KP,MW	S	1,204	ND	22	31	O	ND	ND	5.0	6
White River	5/1	3	KP,MW	S	1,194	ND	22	31	O	ND	ND	5.0	26
Ford Arm	5/3	1	TT,PF	S	619	41	22	32	R	20	16/16	4.5	36
Ford Arm	5/3	2	TT,PF	S	818	42	22	32	R	20	16/16	4.5	37
Harris	5/3	1	MW, BW	S	438	ND	22	31	O	ND	5.18	6.5	1
Harris	5/3	2	MW, BW	S	3,640	ND	22	31	O	ND	5.18	6.5	59
Harris	5/3	3	KP, DL	S	3,236	ND	22	31	O	ND	5.18	6.5	24
Harris	5/3	4	KP,DL	S	2,984	ND	22	31	O	ND	5.18	6.5	0
Harris	5/3	5	KP,DL	S	582	ND	22	31	O	ND	5.18	6.5	0
Pleasant Bay	5/3	1	DT, JN	S	1,117	ND	22	32	O	27.00	6.50	2.9	37
Pleasant Bay	5/3	2	DT, JN	S	638	ND	22	32	O	27.00	6.50	2.9	25
Slippery	5/3	1	DF, VG	S	601	ND	22,23	32	O	33.00	4.90	3.0	9
Slippery	5/3	2	DF, VG	S	1,852	ND	22	32	O	33.00	4.90	3.0	31
Eagle/Luck	5/4	1	KP, DL	S	1,279	ND	22	31	O,R	ND	4.57	7.0	8
Eagle/Luck	5/4	2	KP, DL	S	1,796	ND	22	31	O,R	ND	4.57	7.0	4

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Stream	Survey date	Survey reach	Observers[a]	Survey type[b]	Reach distance surveyed (m)[c]	Tide code[d]	VIS code[e]	Water level code[f]	Weather code[g]	Staff gauge level (cm)	Secchi disk (m)[h]	Surface water temp. (°C)	Number of live steelhead
Eagle/Luck	5/4	3	KP, DL, MW, LL	S	1,419	ND	22	31	O,R	ND	4.57	7.0	36
Eagle/Luck	5/4	4[i]	NA	ND	1,221	ND	ND	31	O,R	ND	ND	ND	ND[i]
Peterson	5/4	1	DT, BG	S	1,484	ND	23	31	R	24.00	2.50	2.1	5
Sitkoh	5/4	1	TT,PF	S	894	41	22	31	R	ND	14/11	4.0	10
Sitkoh	5/4	2	TT,PF	S	1,781	41	22	31	R	ND	14/11	4.0	17
Sitkoh	5/4	3	TT,PF	S	2,145	41	22	31	R	ND	14/11	4.0	39
Petersburg	5/9	1	DF, VG	S	1,483	ND	23	31	O,R	-34.00	1.80	4.0	6
Petersburg	5/9	2	DF, VG	S	2,003	ND	23	31	O,R	-34.00	1.80	4.0	5
Petersburg	5/9	3	DF, VG	S	1,862	ND	23	31	O,R	-34.00	1.80	4.0	13
Petersburg	5/9	4[j]	DF, VG	ND	–[j]	42	ND	31	O,R	-34.00	1.80	ND	ND[j]
Ford Arm	5/10	1	TT, PF	S	619	42	22	32	R	21.5	17/19	4.5	48
Ford Arm	5/10	2	TT, PF	S	818	42	22	32	R	21.5	17/19	4.5	77
White River	5/10	1	KP, MW	S	2,048	ND	22	32	O	ND	4.57	3.5	33
White River	5/10	2	KP, MW	S	2,310	ND	22	32	O	ND	4.57	3.5	13
White River	5/10	3	KP, MW	S	1,420	ND	22	32	O	ND	4.57	3.5	17
Harris	5/14	1	KP, TJ	S	438	ND	23	31	C	ND	ND	6.0	1
Harris	5/14	2	KP, TJ	S	3,640	ND	23	31	C	ND	ND	6.0	11
Harris	5/14	3	MW, BW	S	3,236	ND	23	31	C	ND	ND	6.0	15
Harris	5/14	4	MW, BW	S	2,984	ND	23	31	C	ND	ND	6.0	5
Harris	5/14	5	MW, BW	S	582	ND	23	31	C	ND	ND	6.0	0
Slippery	5/14	1	DF, VG	S	601	ND	22	32	O,C	24.00	5.50	5.0	21
Slippery	5/14	2	DF, VG	S	1,852	ND	21	32	O,C	24.00	5.50	5.0	62
Pleasant Bay	5/15	1	DT, BG	S	1,117	ND	22	32	O	25.00	6.00	3.8	47
Pleasant Bay	5/15	2	DT, BG	S	638	ND	22	32	O	25.00	6.00	3.8	29
White River	5/16	1	KP, MW	S	2,815	ND	21	33	O	ND	4.27	4.0	16
White River	5/16	2	KP, MW	S	1,204	ND	21	33	O	ND	4.27	4.0	5
White River	5/16	3	KP, MW	S	1,194	ND	21	33	O	ND	4.27	4.0	24
Ford Arm	5/17	1	TT, PF	S	619	43	22	32	O	19	14/16.5	4.0	43

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Appendix A2.–Page 3 of 4.

Stream	Survey date	Survey reach	Observers[a]	Survey type[b]	Reach distance surveyed (m)[c]	Tide code[d]	VIS code[e]	Water level code[f]	Weather code[g]	Staff gauge level (cm)	Secchi disk (m)[h]	Surface water temp. (°C)	Number of live steelhead
Ford Arm	5/17	2	TT, PF	S	818	43	22	32	O	19	14/16.5	4.0	71
Petersburg	5/17	1	DF, VG	S	1,483	ND	21	32	O,C	-81.00	6.10	5.0	44
Petersburg	5/17	2	DF, VG	S	2,003	ND	21	33	O,C	-81.00	6.10	5.0	24
Petersburg	5/17	3	DF, VG	S	1,862	ND	21	33	O,C	-81.00	6.10	5.0	27
Petersburg	5/17	4[j]	DF, VG	S,B	—[j]	42	22	33	O,C	-81.00	6.10	5.0	12[j]
Peterson	5/17	1	DT, BG	S	1,484	ND	22	32	O	34.50	ND	3.7	12
Sitkoh	5/18	1	TT,PF	S	894	41	22	32	O	ND	12/15	5.0	6
Sitkoh	5/18	2	TT,PF	S	1,781	41	22	32	O	ND	12/15	5.0	18
Sitkoh	5/18	3	TT,PF	S	2,145	41	22	32	O	ND	12/15	5.0	45
Slippery	5/22	1	DF, VG	S	601	ND	22	31,32	O	49.00	4..90	6.5	2
Slippery	5/22	2	DF, VG	S	1,852	ND	22	31,32	O	49.00	4..90	6.5	30
Eagle/Luck	5/23	1	KP, TJ	S	1,279	ND	23	31	O	ND	4.88	8.0	12
Eagle/Luck	5/23	2	KP, TJ	S	1,796	ND	23	31	O	ND	4.88	8.0	0
Eagle/Luck	5/23	3	KP, TJ	S	1,419	ND	23	31	O	ND	4.88	8.0	104
Eagle/Luck	5/23	4[i]	NA	ND	1,221	ND	ND	31	O	ND	ND	ND	ND[i]
Petersburg	5/24	1	DF, VG	S	1,483	ND	21	32	C	-70.00	6.80	7.0	27
Petersburg	5/24	2	DF, VG	S	2,003	ND	21	32	C	-70.00	6.80	7.0	20
Petersburg	5/24	3	DF, VG	S	1,862	ND	21	32	C	-70.00	6.80	7.0	25
Petersburg	5/24	4[j]	DF, VG	S,B	—[j]	42	22	32	C	-70.00	6.80	7.0	40[j]
Pleasant Bay	5/24	1	DT, BG	S	1,117	ND	21	32	C	25.00	9.00	5.5	38
Pleasant Bay	5/24	2	DT, BG	S	638	ND	21	32	C	25.00	9.00	5.5	31
Peterson	5/25	1	DT,JN	S	1,484	ND	23	32	O	28.00	3.50	5.1	4
Sitkoh	5/30	1	TT,PF	S	894	41	23	31	O,R	ND	15/17	6.5	1
Sitkoh	5/30	2	TT,PF	S	1,781	43	23	31	O,R	ND	15/17	6.5	2
Sitkoh	5/30	3	TT,PF	S	2,145	42	23	31	O,R	ND	15/17	6.5	2
Eagle/Luck	6/4	1	KP, TJ, MW	S	1,279	ND	23	31	C	ND	3.35	8.0	13
Eagle/Luck	6/4	2	KP, TJ, MW	S	1,796	ND	23	31	C	ND	3.35	8.0	0

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Appendix A2.–Page 4 of 4.

Stream	Survey date	Survey reach	Observers[a]	Survey type[b]	Reach distance surveyed (m)[c]	Tide code[d]	VIS code[e]	Water level code[f]	Weather code[g]	Staff gauge level (cm)	Secchi disk (m)[h]	Surface water temp. (°C)	Number of live steelhead
Eagle/Luck	6/4	3	KP, TJ, MW	S	1,419	ND	23	31	C	ND	3.35	8.0	64
Eagle/Luck	6/4	4[i]	ND	ND	1,221	ND	ND	31	C	ND	ND	ND	ND[i]
Petersburg	6/7	1	DF, VG	S	1,483	ND	22	32	R	-70.00	5.80	6.5	4
Petersburg	6/7	2	DF, VG	S	2,003	ND	21,22	32	R	-70.00	5.80	6.5	3
Petersburg	6/7	3	DF, VG	S	1,862	ND	21,22	32	R	-70.00	5.80	6.5	2
Petersburg	6/7	4[j]	DF, VG	S,B	–[j]	43	21,22	32	R	-70.00	5.80	6.5	1[j]

Note: ND represents no data.

[a] Observers: BW (Betsy Walker), BG (Brian Glynn), DT (Dan Teske), DL (David Love), DF (Doug Fleming), KP (Kelly Piazza), KF (Kyle Ferguson), JN (Jeff Nichols), JL (Judy Lum), MM (Monica Matz), MW (Mike Wood), PF (Patrick Fowler),PR(Phil Richards), RS (Ryan Sylva), TAJ (Troy Jaecks), TJ (Todd Johnson), TT (Troy Tydingco), and VG (Vera Goudima). (w) indicates who the walker was.

[b] S = snorkel, F = foot, R&R = rod and reel.

[c] Reach distances were measured in ARC GIS for this reporting period and may differ from those reported previously due to increased precision in measurement.

[d] 41 = high, 42 = low, 43 = intermediate.

[e] 21 = excellent visibility, 22 = normal visibility, 23 = poor visibility.

[f] 31 = high water, 32 = normal water, 33 = low water.

[g] C = clear, O = overcast, R = rain, W = wind on water surface, O/C = overcast with breaks.

[h] The point at which the Secchi disk disappeared was the distance that was recorded, but observers on the Sitka team also record this distance both in the shade and in the sun (the smaller number is the number measured facing into the sun and the larger number is the measurement with the sun at the snorkelers' backs).

[i] Eagle Creek reach 4 steelhead count is not added into the total count for the survey as it is no longer surveyed due to safety issues.

[j] The survey count at the cabin hole on Petersburg Creek is used in the total count and regional trend line. Only during years 1997, 1998, and 1999 was the cabin hole not surveyed. From 2000–2004, the cabin hole was added into the reach 2 count. Beginning in 2004 the number was split out and kept as a separate reach. Although the number of reaches has differed since 2000, the area surveyed is the essentially the same at Petersburg Creek since 2000.

Appendix A3.–Counts of steelhead from 2013 surveys by date, stream and reach of stream along with measured environmental variables.

Stream	Survey date	Survey reach	Observers[a]	Survey type[b]	Reach distance surveyed (m)[c]	Tide code[d]	VIS code[e]	Water level code[f]	Weather code[g]	Staff gauge level (cm)	Secchi disk (m)[h]	Surface water temp. (°C)	Number of live steelhead
White River	4/15	1	KP, MW	S	2,815	ND	21	33	C	ND	7.50	5.0	45
White River	4/15	2	KP, MW	S	1,204	ND	21	33	C	ND	7.50	5.0	13
White River	4/15	3	KP, MW	S	1,194	ND	21	33	C	ND	7.50	5.0	15
Harris River	4/16	1	KP, MW	S	438	ND	21	33	O	ND	9.50	6.0	2
Harris River	4/16	2	KP, MW	S	3,640	ND	21	33	O	ND	9.50	6.0	92
Harris River	4/16	3	BW, SB	S	3,236	ND	21	33	O	ND	9.50	6.0	19
Harris River	4/16	4	BW, SB	S	2,984	ND	21	33	O	ND	9.50	6.0	0
Harris River	4/16	5	BW, SB	S	582	ND	21	33	O	ND	9.50	6.0	0
Eagle/Luck	4/17	1	KP, MW	S	1,279	ND	22	33	O	ND	4.00	5.0	0
Eagle/Luck	4/17	2	KP, MW	S	1,796	ND	22	33	O	ND	4.00	5.0	2
Eagle/Luck	4/17	3	KP, MW	S	1,419	ND	22	33	O	ND	4.00	5.0	42
Eagle/Luck	4/17	4[i]	KP, MW	S	1,221[i]	ND	22	33	O	ND	4.00	5.0	24[i]
White River	4/22	1	KP, MW	S	2,815	ND	21	33	C	ND	6.00	6.0	55
White River	4/22	2	KP, MW	S	1,204	ND	21	33	C	ND	6.00	6.0	20
White River	4/22	3	KP, MW	S	1,194	ND	21	33	C	ND	6.00	6.0	35
Harris River	4/23	1	BW, SB	S	438	ND	21	33	O	ND	9.50	6.0	0
Harris River	4/23	2	BW, SB	S	3,640	ND	21	33	O	ND	9.50	6.0	124
Harris River	4/23	3	KP, MW, BC	S	3,236	ND	21	33	O	ND	9.50	6.0	38
Harris River	4/23	4	KP, MW, BC	S	2,984	ND	21	33	O	ND	9.50	6.0	4
Harris River	4/23	5	KP, MW, BC	S	582	ND	21	33	O	ND	9.50	6.0	0
Petersburg	4/23	1	DF, VG	S	1,483	ND	21	33	C	-98.00	6.40	2.5	55
Petersburg	4/23	2	DF, VG	S	2,003	ND	21	33	C	-98.00	6.40	2.5	34
Petersburg	4/23	3	DF, VG	S	1,862	ND	21	33	C	-98.00	6.40	2.5	43
Petersburg	4/23	4[j]	PF, VG	S	–[j]	42	21	33	C	-98.00	6.40	2.5	38[j]
Port St. Nick	4/23	ND	KP, MW, BC	F	ND	ND	22	32	O	ND	ND	ND	12

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Appendix A3.–Page 2 of 4.

Stream	Survey date	Survey reach	Observers[a]	Survey type[b]	Reach distance surveyed (m)[c]	Tide code[d]	VIS code[e]	Water level code[f]	Weather code[g]	Staff gauge level (cm)	Secchi disk (m)[h]	Surface water temp. (°C)	Number of live steelhead
Eagle/Luck	4/24	1	BC, KP, MW	S	1,279	ND	22	33	O	ND	1.25	6.0	1
Eagle/Luck	4/24	2	BC, KP, MW	S	1,796	ND	22	33	O	ND	1.25	6.0	0
Eagle/Luck	4/24	3	BC, KP, MW	S	1,419	ND	22	33	O	ND	1.25	6.0	88
Eagle/Luck	4/24	4[i]	BC, KP, MW	S	1,221[i]	ND	22	33	O	ND	1.25	6.0	15[i]
Ward Creek	4/25	1	KP, MW	S	1,577	ND	22	32	O, R	ND	ND	ND	0
Ward Creek	4/25	2	KP, MW	S	752	ND	22	32	O, R	ND	ND	ND	34
Ward Creek	4/25	3	KP, MW	S	879	ND	22	32	O, R	ND	ND	ND	0
Ford Arm	4/30	1	TT, PF, MM	S	619	43	21	33	O	66	17/15	3.5	14
Ford Arm	4/30	2	TT, PF, MM	S	818	43	21	33	O	66	17/16	3.5	76
White River	5/1	1	KP, MW	S	2,815	ND	22	32	R	ND	7.50	4.5	53
White River	5/1	2	KP, MW	S	1,204	ND	22	32	R	ND	7.50	4.5	33
White River	5/1	3	KP, MW	S	1,194	ND	22	32	R	ND	7.50	4.5	17
Harris River	5/6	1	TJ, KP, MW	S	438	ND	22	31	C	ND	7.50	7.5	0
Harris River	5/6	2	TJ, KP, MW	S	3,640	ND	22	31	C	ND	7.50	7.5	98
Harris River	5/6	3	BK, SB	S	3,236	ND	22	31	C	ND	7.50	7.5	14
Harris	5/6	4	BK, SB	S	2,984	ND	22	31	C	ND	7.50	7.5	2
Harris	5/6	5	BK, SB	S	582	ND	22	31	C	ND	7.50	7.5	0
Eagle/Luck	5/7	1	TJ, MW, KP	S	1,279	ND	22	31	C	ND	2.25	7.5	22
Eagle/Luck	5/7	2	TJ, MW, KP	S	1,796	ND	22	31	C	ND	2.25	7.5	2
Eagle/Luck	5/7	3	TJ, MW, KP	S	1,419	ND	22	31	C	ND	2.25	7.5	130
Eagle/Luck	5/7	4[i]	TJ, MW, KP	S	1,221[i]	ND	ND	31	C	ND	2.25	7.5	ND[i]
Ford Arm	5/7	1	TT, MM JS	S	619	43	22	32	C	68	12/19	4.5	55
Ford Arm	5/7	2	TT, MM JS	S	818	43	22	32	C	68	12/19	4.5	68
Pleasant Bay	5/8	1	DT, BG, JL	S	1,117	ND	21	32	C	ND	5.50	4.1	49
Pleasant Bay	5/8	2	DT, BG, JL	S	638	ND	21	32	C	ND	5.50	4.1	28
Petersburg	5/9	1	PF, VG	S	1,483	ND	22	32	C	-72.00	4.60	3.0	57
Petersburg	5/9	2	PF, VG	S	2,003	ND	22	32	C	-72.00	4.60	3.0	72

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Appendix A3.–Page 3 of 4.

Stream	Survey date	Survey reach	Observers[a]	Survey type[b]	Reach distance surveyed (m)[c]	Tide code[d]	VIS code[e]	Water level code[f]	Weather code[g]	Staff gauge level (cm)	Secchi disk (m)[h]	Surface water temp. (°C)	Number of live steelhead
Petersburg	5/9	3	PF, VG	S	1,862	ND	22	32	C	-72.00	4.60	3.0	86
Petersburg	5/9	4[j]	PF, VG	S	—[j]	42	22	32	C	-72.00	4.60	3.0	26[j]
Peterson	5/9	1	DT, BG, JL	S	1,484	ND	23	31	C	17.00	3.50	2.4	1
Ford Arm	5/16	1	TT, MM JS	S	619	42	22	31	O	114.00	21/24	4.5	59
Ford Arm	5/16	2	TT, MM JS	S	818	42	22	31	O	114.00	21/25	4.5	95
Pleasant Bay	5/16	1	DT, BG, JL	S	1,117	ND	22	31	O	ND	5.50	5.3	49
Pleasant Bay	5/16	2	DT, BG, JL	S	638	ND	22	31	O	ND	5.50	6.3	26
Peterson	5/17	1	DT, BG, JL	S	1,484	ND	23	31	O	13.00	2.00	3.3	12
Sitkoh	5/18	1	TT, MM JS	S	894	41	22	31	C	ND	9/17	5.5	9
Sitkoh	5/18	2	TT, MM JS	S	1,781	41	22	31	C	ND	9/17	5.5	29
Sitkoh	5/18	3	TT, MM JS	S	2,145	41	22	31	C	ND	9/17	5.5	34
Ward	5/21	1	TJ, MW	S	1,577	ND	23	31	O	ND	ND	ND	NS
Ward	5/21	2	TJ, MW	S	752	ND	23	31	O	ND	ND	ND	31
Ward	5/21	3	TJ, MW	S	879	ND	23	31	O	ND	ND	ND	NS
Peterson	5/22	1	DT, BG, JL	S	1,484	ND	22	32	C	19.00	4.00	3.9	29
Petersburg	5/23	1	VG, TT	S	1,483	ND	21	32	C	-80	7.4	6.0	41
Petersburg	5/23	2	VG, TT	S	2,003	ND	21	32	C	-80	7.4	6.0	43
Petersburg	5/23	3	VG, TT	S	1,862	ND	21	32	C	-80	7.4	6.0	38
Petersburg	5/24	4[j]	VG, TT	S	—[j]	ND	21	32	C	-80	7.4	6.0	45[j]
Sitkoh	5/23	1	PF, MM, DG	S	894	43	22	32	C	ND	14/21	8.0	6
Sitkoh	5/23	2	PF, MM, DG	S	1,120	43	21	32	C	ND	14/22	8.0	39
Sitkoh	5/23	3	PF, MM, DG	S	2,145	41	21	32	C	ND	14/23	8.0	54
Eagle/Luck	5/23	1	KP, MW	S	1,279	ND	22	32	O	ND	7.50	7.0	7
Eagle/Luck	5/23	2	KP, MW	S	1,796	ND	22	32	O	ND	7.50	7.0	0
Eagle/Luck	5/23	3	KP, MW	S	1,419	ND	22	32	O	ND	7.50	7.0	54
Eagle/Luck	5/23	4[i]	KP, MW	S	1,221[i]	ND	22	32	O	ND	7.50	7.0	ND[i]

-continued-

Stream	Survey date	Survey reach	Observers[a]	Survey type[b]	Reach distance surveyed (m)[c]	Tide code[d]	VIS code[e]	Water level code[f]	Weather code[g]	Staff gauge level (cm)	Secchi disk (m)[h]	Surface water temp. (°C)	Number of live steelhead
Peterson	5/28	1	DT, BG, JL(w)	S	1,484	ND	22	33	C	26.00	5.30	8.2	7
Ward	5/29	1	KP, MW	S	1,577	ND	22	33	O	ND	4.00	9.0	8
Ward	5/29	2	KP, MW	S	752	ND	22	33	O	ND	5.00	9.0	27
Ward	5/29	3	KP, MW	S	879	ND	22	33	O	ND	6.00	9.0	ND
Ford Arm	5/30	1	PF, TT, MM	S	619	43	22	31	C,O	46.00	17/17	9.2	62
Ford Arm	5/30	2	PF, TT, MM	S	818	43	22	31	C,O	46.00	17/17	9.2	77
Sitkoh	5/31	1	TT, PF, MM	S	894	42	22	31	R	ND	14/16	12.7	4
Sitkoh	5/31	2	TT, PF, MM	S	1,784	42	22	31	R	ND	14/16	12.7	8
Sitkoh	5/31	3	TT, PF, MM	S	2,145	42	22	31	R	ND	14/16	12.7	24

Note: ND represents no data.

[a] Observers: BC (Bob Chadwick), BW (Betsy Walker), BG (Brian Glynn), BK (Betsy Krier), DT (Dan Teske), DL (David Love), DF (Doug Fleming), KP (Kelly Piazza), JS (Jason Sexton), JN (Jeff Nichols), JL (Judy Lum), MM (Monica Matz), M2M (Mary Meucci) MW (Mike Wood), PF (Patrick Fowler), RS (Ryan Sylva), Sarah Brandy (SB), (TJ) Todd Johnson), TT (Troy Tydingco), and VG (Vera Goudima).

[b] S = snorkel, F = foot, R&R = rod and reel.

[c] Reach area breaks were verified with GPS and subsequent reach distances were measured in ARC GIS for this reporting period, and may differ from those reported previously due to increased precision in measurement.

[d] 41 = high, 42 = low, 43 = intermediate.

[e] 21 = excellent visibility, 22 = normal visibility, 23 = poor visibility.

[f] 31 = high water, 32 = normal water, 33 = low water.

[g] C = clear, O = overcast, R = rain, W = wind on water surface, O/C = overcast with breaks.

[h] The point at which the Secchi disk disappeared was the distance that was recorded, but observers on the Sitka team also record this distance both in the shade and in the sun (the smaller number is the number measured facing into the sun and the larger number is the measurement with the sun at the snorkeler's backs).

[I] Eagle Creek reach area 4 steelhead count is not added into the total count for the survey as it is no longer surveyed due to safety issues.

[j] The survey count at the cabin hole on Petersburg Creek is used in the total count and regional trend line. Only during years 1997, 1998, and 1999 was the cabin hole not surveyed. From 2000 – 2004, the cabin hole was added into the reach 2 count. Beginning in 2003 the number was split out and kept as a separate reach. While the number of reaches has differed since 2000, the area surveyed is the essentially the same at Petersburg Creek since 2000.

APPENDIX B: STEELHEAD INDEX STREAMS SURVEYED BY ADF&G, 1997–2013

Appendix B1.–Present (first 10) and past steelhead index streams surveyed by ADF&G DSF from 1997–2013.

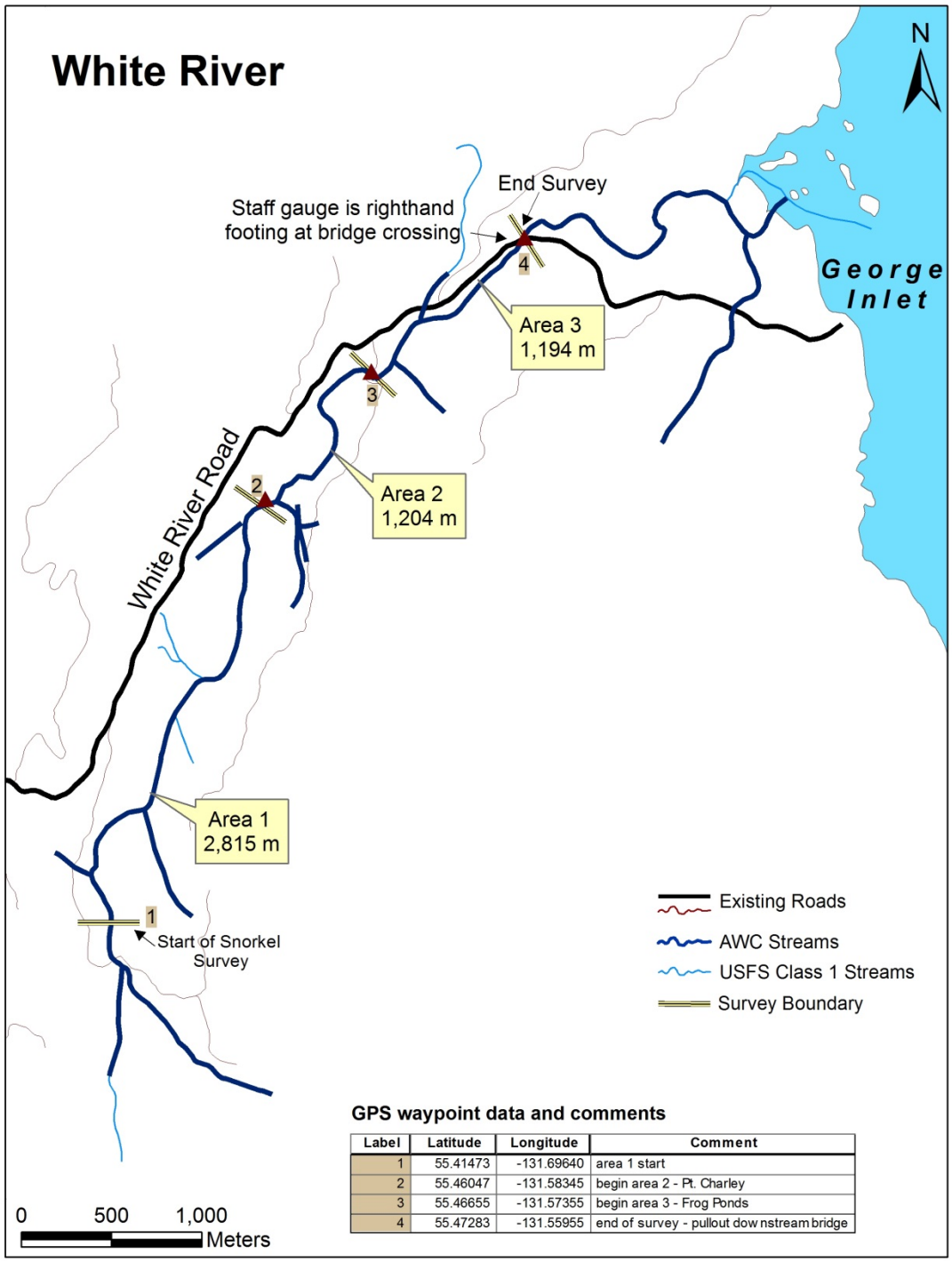
Steelhead System	Management Area	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
White River	Ketchikan	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Ward Creek	Ketchikan	X	X	–[a]	–[a]	–[a]	–[a]	X	X	X	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	X
Harris River	Prince of Wales	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Eagle/Luck Creek	Prince of Wales	X	X	X	X	–[a]	X	X	X	X	X	X	X	X	X	X	X	X
Petersburg Creek	Petersburg	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Slippery Creek	Petersburg	–[a]	–[a]	–[a]	X	X	X	X	X	X	X	X	X	X	X	X	X	–[a]
Ford Arm Creek	Sitka	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sitkoh Creek	Sitka	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Pleasant Bay Creek	Juneau	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Peterson Creek	Juneau	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
McDonald Lake Creek	Ketchikan	X	X	X	X	X	X	X	X	X	X	X	X	X	–[a]	–[a]	–[a]	–[a]
Humpback Creek	Ketchikan	X	X	X	X	X	X	X	X	X	X	X	X	X	X	–[a]	–[a]	–[a]
Ketchikan Creek	Ketchikan	X	X	X	X	X	X	X	X	X	–[a]	–[a]	–[a]	X	–[a]	–[a]	–[a]	–[a]
Naha River	Ketchikan	X	X	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]
108 Creek	Prince of Wales	X	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]
12 Mile Creek	Prince of Wales	–[a]	–[a]	X	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]
Big Ratz Creek	Prince of Wales	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	X	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]
Karta River	Prince of Wales	–[a]	X	X	X	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]		–[a]	–[a]	–[a]
Bear Creek (aka Big Creek)	Petersburg	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	X	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]
Marten Creek	Petersburg	X	X	X	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]
Sitkoh River	Sitka	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	X	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]
Starrigavan Creek	Sitka	–[a]	–[a]	X	X	X	–[a]	–[a]	–[a]	X	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]
Windfall Creek	Juneau	X	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]	–[a]

Note: Shaded cells depict the 10 official current steelhead snorkel index systems; unshaded cells identify where snorkel surveys were completed historically, and often sporadically.

[a] No survey occurred in this system during this year.

APPENDIX C: WHITE RIVER

Appendix C1.–White River, Ketchikan Index Stream: AWC # 101-45-10240.



GPS waypoint data and comments

Label	Latitude	Longitude	Comment
1	55.41473	-131.69640	area 1 start
2	55.46047	-131.58345	begin area 2 - Pt. Charley
3	55.46655	-131.57355	begin area 3 - Frog Ponds
4	55.47283	-131.55955	end of survey - pullout dow nstream bridge

Appendix C2.– Description and history of White River steelhead surveys, research and management.

White River (AWC#101-45-10240) is located on the Ketchikan road system on Revillagigedo Island in the ADF&G DSF Ketchikan Management Area. It has 3 reach areas that are surveyed. A 4th reach was dropped in 1998 at the Ketchikan Area Manager's suggestion because that reach was tidally influence slack water where no steelhead had been observed in any of the previous surveys. The White River drains into Clarence Straight.

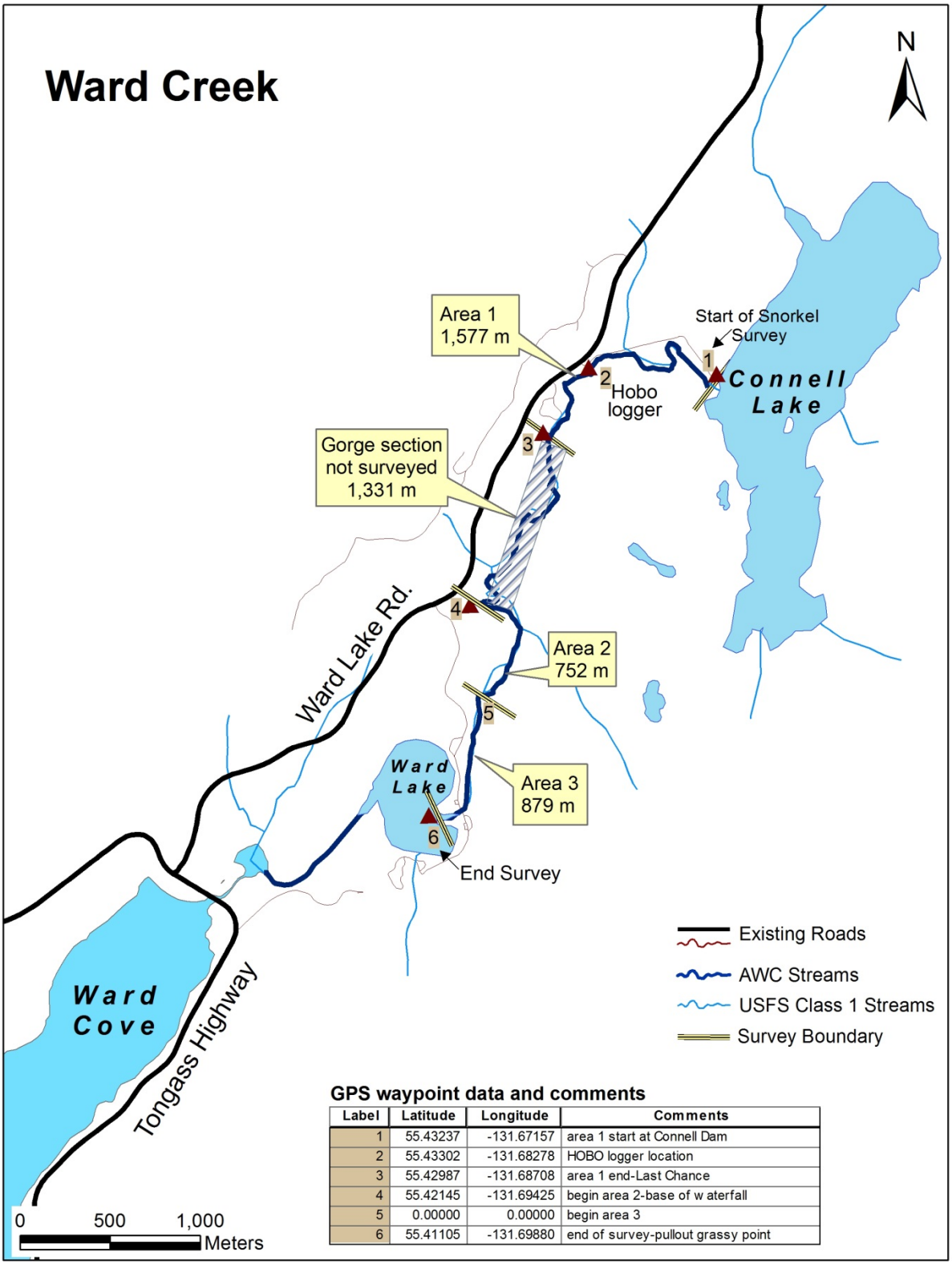
Steelhead index surveys were begun in White River in 1997 and have occurred every year since then. Historically, 17 survey years resulted in 12 bracketed peak counts (71%) and 5 high counts (29%). Bracketed peak counts range from a high of 110 in 2013 to a low of 37 in 2002 with a median peak count of 46 as of 2013. Bracketed peak counts range from as early as April 23 (2013) to as late as May 21(2009).

White River is a popular sport fishing stream on the Ketchikan road system. White River is thought to have only a spring steelhead run that is ocean maturing. White River also has Chinook, coho, and pink salmon, according to the Anadromous Waters Catalog, as well as Dolly Varden trout, cutthroat trout, and rainbow trout. During this reporting period, the White River steelhead sport fishery was managed under the Southeast Region steelhead regulation requiring a 36-inch minimum size limit with 1 fish daily, 2 in possession and a 2-fish annual limit with a harvest record required. Bait is prohibited (5 AAC 47.022). The statewide harvest survey for the reporting period estimates the combined freshwater and saltwater sport catch of steelhead in the entire Ketchikan area was 531 fish (96.8% harvested in freshwater), and the combined freshwater and saltwater sport harvest was 8 fish (all harvested in freshwater) (Alaska Sport Fishing Survey database [Intranet]. 1996– . Anchorage, AK: Alaska Department of Fish and Game, Division of Sport Fish [cited March 29, 2016]. Available from: https://intra.sf.adfg.state.ak.us/swhs_est/). Note: estimates were not available for White River for 2012 and 2013.

No subsistence harvest of steelhead has been reported in White River since 2003 when the federal government began managing subsistence fisheries in Alaska (Jeff Reeves, compilation of subsistence harvest records, USFS Zoned Subsistence Biologist, Craig, Alaska).

APPENDIX D: WARD CREEK

Appendix D1.–Ward Creek, Ketchikan Index Stream: AWC # 101-47-10150.



GPS waypoint data and comments

Label	Latitude	Longitude	Comments
1	55.43237	-131.67157	area 1 start at Connell Dam
2	55.43302	-131.68278	HOBO logger location
3	55.42987	-131.68708	area 1 end-Last Chance
4	55.42145	-131.69425	begin area 2-base of w aterfall
5	0.00000	0.00000	begin area 3
6	55.41105	-131.69880	end of survey-pullout grassy point

Note: GPS waypoints will be collected for the start and end of the survey and for the area breaks during 2014.

Appendix D2.– Description and history of Ward Creek steelhead surveys, research and management.

Ward Creek (AWC#101-47-10150) is located on the Ketchikan road system on Revillagigedo Island in the ADF&G DSF Ketchikan Management Area. In 1997 Ward Creek was surveyed with 5 reach areas, which were reduced in 1998 to 3 reach areas that are currently surveyed. Snorkel surveys at Ward Creek were conducted to evaluate its potential use as index systems (Johnson and Jones 1999).

Steelhead index surveys were begun in Ward Creek in 1997 and occurred in 1998, 2003, 2004, 2005, and 2013. Ward Creek replaced McDonald Lake Creek in 2013 as the Ketchikan Management Area's second steelhead index stream due to safety concerns and efficiency. Historically, 6 survey years resulted in 2 bracketed peak counts (33%) and 4 high counts (67%). Bracketed peak counts ranged from a high of 171 in 2004 to a low of 146 in 2005 (Table 3) with a median peak count of 159 as of 2013.

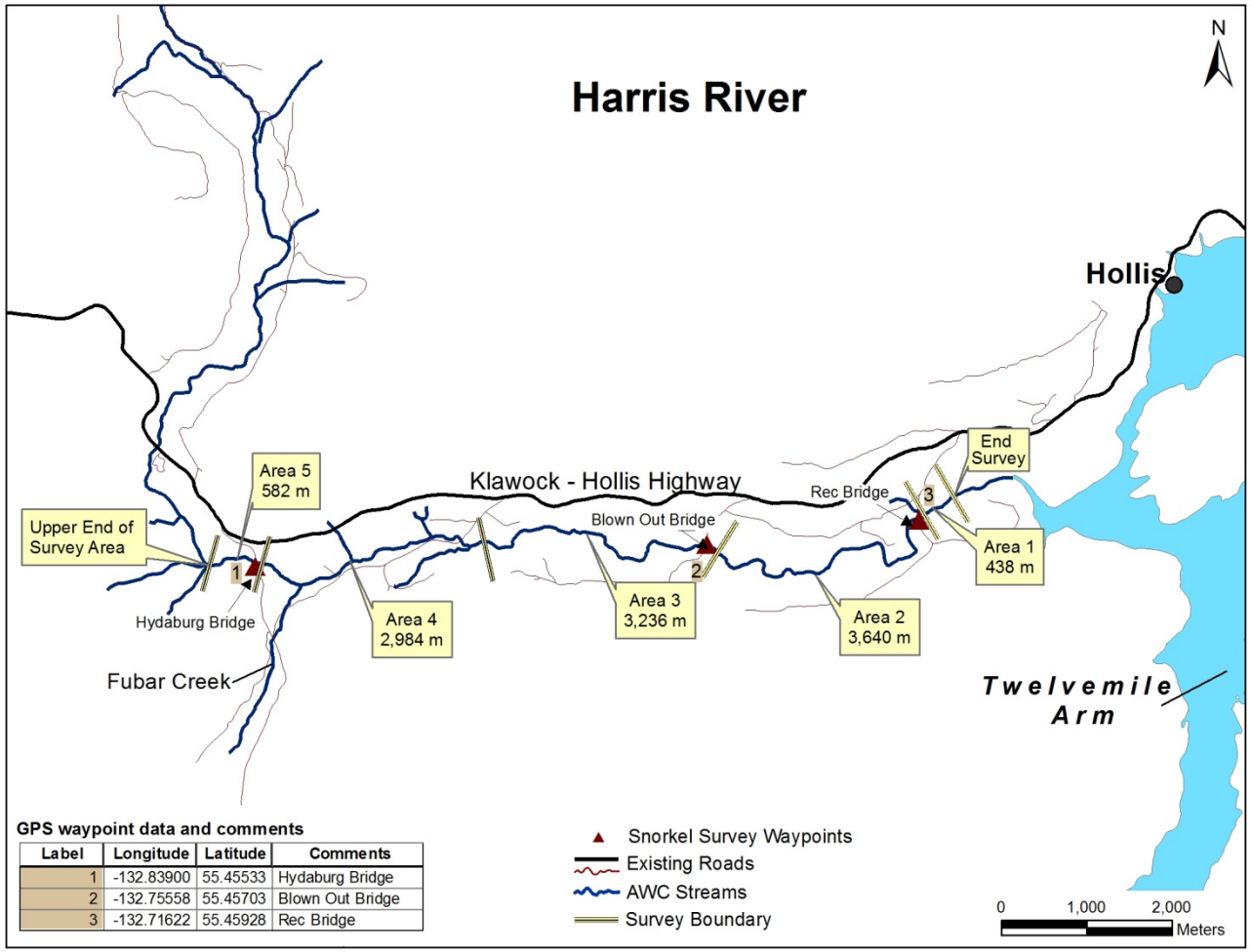
Ward Creek is thought to have both wild steelhead that are stream maturing and return in the fall run and wild steelhead that are ocean maturing and return in the spring. In addition to the wild fish already present, Ward Creek was stocked with hatchery smolt from 1980–1982 (Ketchikan Creek steelhead stocked reared at Deer Mountain Hatchery) and again from 1985-1993 (Klawock River Steelhead stock reared at Klawock Hatchery) (Freeman 1995). The stocking program was halted due to high cost and low production, and to limit potential competition between hatchery steelhead and wild steelhead in Ward Creek (Freeman 1995). Ward Creek also has Chinook, coho, pink, and sockeye salmon according to the Anadromous Waters Catalog, as well as Dolly Varden and cutthroat trout.

Ward Creek is a popular sport fishing stream in Ketchikan. The Ward Creek steelhead sport fishery during this reporting period was regulated as a single-hook only stream and steelhead angling was catch-and-release only, and all steelhead caught must have been released immediately. Bait was prohibited (5AAC 47.023). The statewide harvest survey for the reporting period estimates the combined freshwater and saltwater sport catch of steelhead in the entire Ketchikan area was 531 fish (96.8% harvested in freshwater), and the combined freshwater and saltwater sport harvest was 8 fish (all harvested in freshwater) (Alaska Sport Fishing Survey database [Intranet]. 1996– . Anchorage, AK: Alaska Department of Fish and Game, Division of Sport Fish [cited March 29, 2016]. Available from: https://intra.sf.adfg.state.ak.us/swhs_est/). Note: estimates were not available for Ward Creek during 2012 and 2013.

No subsistence harvest of steelhead has been reported in Ward Creek since 2003 when the federal government began managing subsistence fisheries in Alaska (Jeff Reeves, compilation of subsistence harvest records, USFS Zoned Subsistence Biologist, Craig, Alaska).

APPENDIX E: HARRIS RIVER

Appendix E1.–Harris River, Prince of Wales Index Stream: AWC # 102-60-10820.



Note: GPS waypoints for the upper end of the survey area, area reach break for 3-4, and end of survey will be collected during 2014.

Harris River (AWC#102-60-10820) is located on the road system on Prince of Wales Island on the Klawock-Hollis Highway near Hollis, Alaska, in the ADF&G DSF Prince of Wales Management Area. It has 5 reach areas that are surveyed; reach areas 5 and 1 have shortened since surveys began because very few steelhead were seen year after year in those reaches. Harris River drains into Harris River Bay in Twelve Mile Arm, which drains into Clarence Straight.

Steelhead index surveys were begun in Harris River in 1997 and have occurred every year since then. Visibility in Harris River is exceptionally good due to very clear water. Historically, 17 survey years resulted in 11 bracketed peak counts (65%) and 6 high counts (35%). Bracketed peak counts range from a high of 192 in 1999 to a low of 79 in 2000 with a median peak count of 123 as of 2013. Bracketed peak counts range from as early as April 23 in 2013 to as late as May 13 in 2005.

Harris River is thought to have only a spring steelhead run that is ocean maturing. Harris River also has Chinook, coho, chum, and pink salmon, according to the Anadromous Waters Catalog, as well as Dolly Varden trout, cutthroat trout, and rainbow trout.

A steelhead weir was installed by ADF&G DSF in 2005, and the minimum spawning escapement was 172 steelhead (Piazza et al. 2008). Ten snorkel surveys were performed while the weir was in operation and surveyors observed an average of 68.8% (SD=18.0%) of the weir count (Piazza et al. 2008). The USFS installed a flat panel resistivity counter (with a partial video validation – 44% of the time the weir was operational) to count steelhead during 2005 as well. These panels were located 200m upstream of the weir. The resistivity upstream count was 450 “upstream immigrants” (with a reported upstream efficiency of 80% and a downstream efficiency of 90%) (McCubbing 2005).

As Harris River was logged extensively during the 1950s and 1960s and less so up through the 1990s, the Harris River watershed has recently undergone an extensive stream restoration by the USFS, TNC, as well as other agencies beginning in 2000s which involved riparian thinning, log jam and pool reestablishment and then bank stabilization, LWD additions and floodplain roughening in Fubar Creek and the Harris River (Gubernick 2013; Jacobsen and Bosworth 2007). Emigrating steelhead smolt as well as coho smolt were assessed with a screw trap and resulted in a 185% increase in steelhead smolt production during 2007-2009 (Gubernick 2013).

Harris River has both a sport fishery and a subsistence fishery for steelhead. Harris River steelhead sport fishery is still managed under the Southeast Regionwide steelhead regulation requiring a 36 inch minimum size limit with 1 fish daily, 2 in possession and a 2-fish annual limit with a harvest record required. Bait is prohibited. (5 AAC 47.022) The statewide harvest survey for the reporting period 2012-2013 estimates the combined freshwater and saltwater sport catch of steelhead in the Harris River was 138 fish, and the combined freshwater and saltwater sport harvest was 6 fish (Alaska Sport Fishing Survey database [Intranet]. 1996– . Anchorage, AK: Alaska Department of Fish and Game, Division of Sport Fish (cited March 29, 2016). Available from: https://intra.sf.adfg.state.ak.us/swhs_est/).

There was only one closure during the history of the ADF&G DSF snorkel surveys at Harris River. Harris River along with other streams on Prince of Wales Island and Kosciusko Island were closed by emergency order on November 9, 2004 to the retention of steelhead. During this closure steelhead needed to be released immediately and could not have been removed from by water by anglers. This closure was to protect small runs of fall run steelhead from potential overharvest as the “Federal Subsistence regulations for these areas provided for a winter season from December 1 through the last day of February, with a harvest limit of 2 per household” (E.O. No. 1-SH-B-26-04). This was the only closure to the steelhead sport fishery to date in Harris River since the overhaul of the 1994 steelhead regulations.

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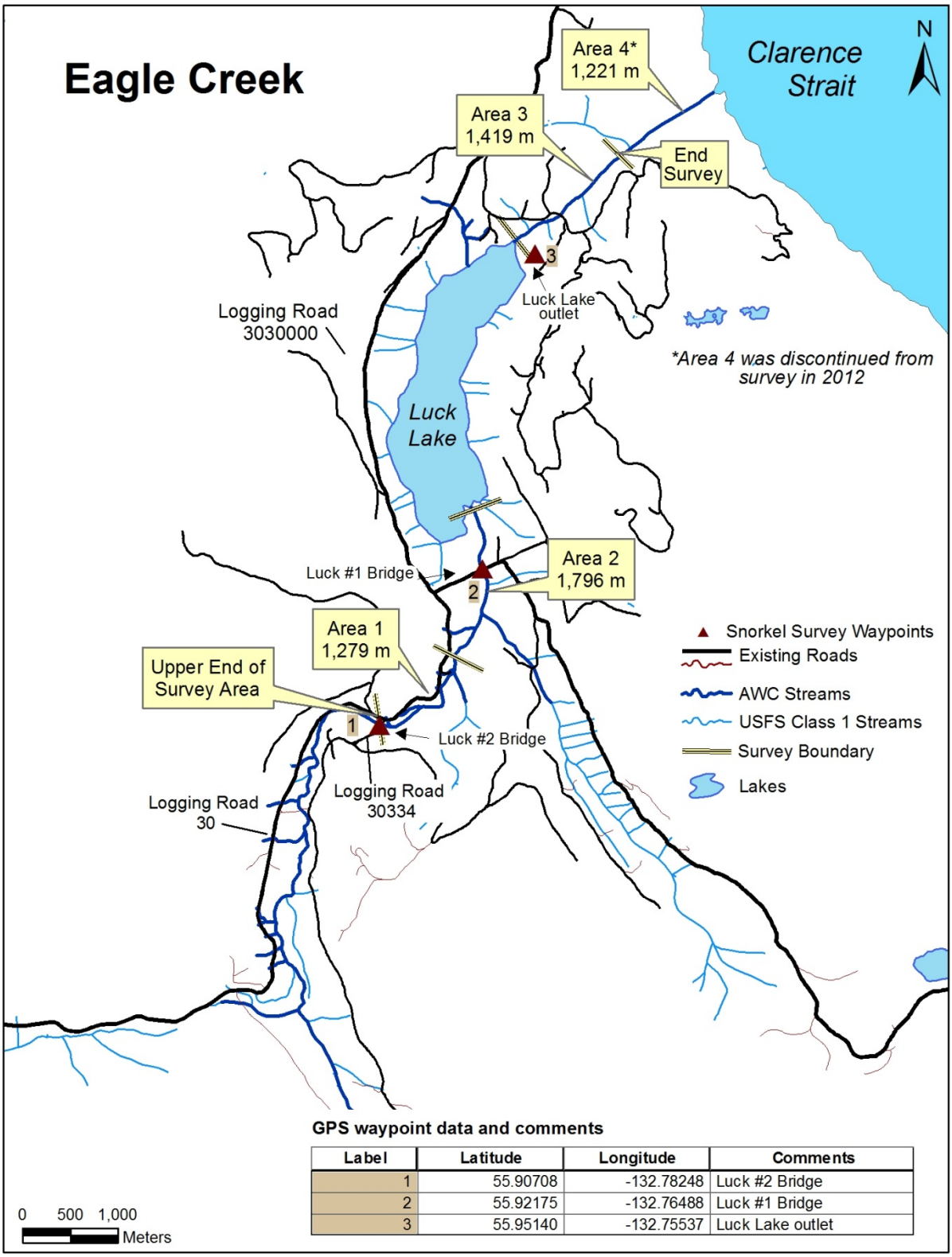
No subsistence harvest of steelhead was reported on the Harris River during the 2012-2013 study period. The reported harvest on the Harris River since 2003 when the federal government began managing subsistence fisheries in Alaska was 10 steelhead (Jeff Reeves, compilation of subsistence harvest records, USFS Zoned Subsistence Biologist, Craig, Alaska). The Department of Interior subsistence regulations state that: winter season subsistence harvest regulations (Dec. 1- Last day of Feb.) are 2 steelhead trout per household on Prince of Wales Island. However, only 1 steelhead may be harvested by a household from a particular drainage. Spring season (Mar.1-May 31) subsistence steelhead harvest regulations are 5 steelhead trout per household. However, only 2 steelhead may be harvested by a household from a particular drainage. Gear is dip net, handline, spear, and rod and reel (http://www.doi.gov/subsistence/regulation/fish_shell/upload/Southeast.pdf).

APPENDIX F: EAGLE/LUCK CREEK

Appendix F1.–Eagle Creek, Prince of Wales Index Stream: AWC # 106-10-10300.



GPS waypoint data and comments

Label	Latitude	Longitude	Comments
1	55.90708	-132.78248	Luck #2 Bridge
2	55.92175	-132.76488	Luck #1 Bridge
3	55.95140	-132.75537	Luck Lake outlet

Appendix F2.–Description and history of Eagle/Luck Creek steelhead surveys, research and management.

Eagle/Luck Creek (AWC#102-10-10300) encompasses the inlet stream (known as Luck Creek) and outlet stream to Luck Lake (Eagle Creek), and is located on the road system on Prince of Wales Island between Thorne Bay and Coffman Cove, Alaska, in the ADF&G DSF Prince of Wales Management Area (approximately 3 km south of Coffman Cove). Eagle Creek has 3 reach areas that are currently surveyed. Historically, Eagle Creek was surveyed with 4 reach areas and during 2008 with 5 reach areas. Reach area 4 (the most downstream reach area) was problematic and often skipped, and as a result it was dropped in 2013 due to safety concerns. (In this report, all bracketed peak counts and high reported do not include reach area 4 for consistency and comparability). Eagle Creek drains into and out of Luck Lake (where fall steelhead are thought to overwinter) and then into Clarence Straight. Eagle Creek was logged during the 1960s (Luck Lake Restoration Environmental Assessment 2013).

Steelhead index surveys were begun in Eagle Creek in 1997 and have occurred every year except for 2001 when Eagle Creek survey was eliminated due to low budgets. Eagle Creek is a challenging snorkel survey due to poor visibility (tannic), fast water, and rapids. Historically, 16 survey years resulted in 7 bracketed peak counts and 9 high counts (77%). Bracketed peak counts range from a high of 154 in 2013 to a low of 35 in 2022 with a median peak count of 82 as of 2013. Bracketed peak counts range from as early as May 5 in 2000 to as late as May 23 in 2012.

A steelhead weir was installed by ADF&G DSF in 2006, and the minimum spawning escapement was 172 steelhead (Piazza et al. 2008). Steelhead scales analyzed from this project indicated that most Eagle Creek steelhead smolt were 4-year-old fish (Piazza et al. 2008). One percent of the adults counted through the weir in 2005 were greater than or equal to 36″, and the average length of these steelhead adults was 782 mm (SE = 5.3) (30.8″) (Piazza et al. 2008). Piazza et al. (2008) performed 9 snorkel surveys during the 2006 and they observed 51.9% of the cumulative weir count during 2005.

Eagle Creek has both a spring steelhead run that is ocean maturing and a fall run that is stream maturing. Eagle Creek also has Chinook, coho, pink, and sockeye salmon, according to the Anadromous Waters Catalog, as well as Dolly Varden trout, cutthroat trout, and rainbow trout.

Eagle/Luck Creek watershed is also a high-priority watershed for stream restoration with proposed addition of large wood to be added to the middle East Fork Luck Creek tributary as early as July 2015 and wood supplementation on the mainstem of Luck Creek somewhat earlier (Tom Cady, Project IDT Leader, Craig Ranger District, personal communication).

Eagle Creek has both a sport fishery and a subsistence fishery for steelhead. Eagle/Luck Creek steelhead sport fishery is managed under the Prince of Wales Island Area Freshwater Special Regulations with non-retention of steelhead. Bait is prohibited (5 AAC 47.023). The statewide harvest survey for the reporting period 2012-2013 estimates that the combined freshwater and saltwater sport catch of steelhead in the Eagle/Luck Creek was 1205 fish, and the combined freshwater and saltwater sport harvest was an estimated 0 fish (Alaska Sport Fishing Survey database [Intranet]. 1996– . Anchorage, AK: Alaska Department of Fish and Game, Division of Sport Fish [cited March 29, 2016]. Available from: https://intra.sf.adfg.state.ak.us/swhs_est/).

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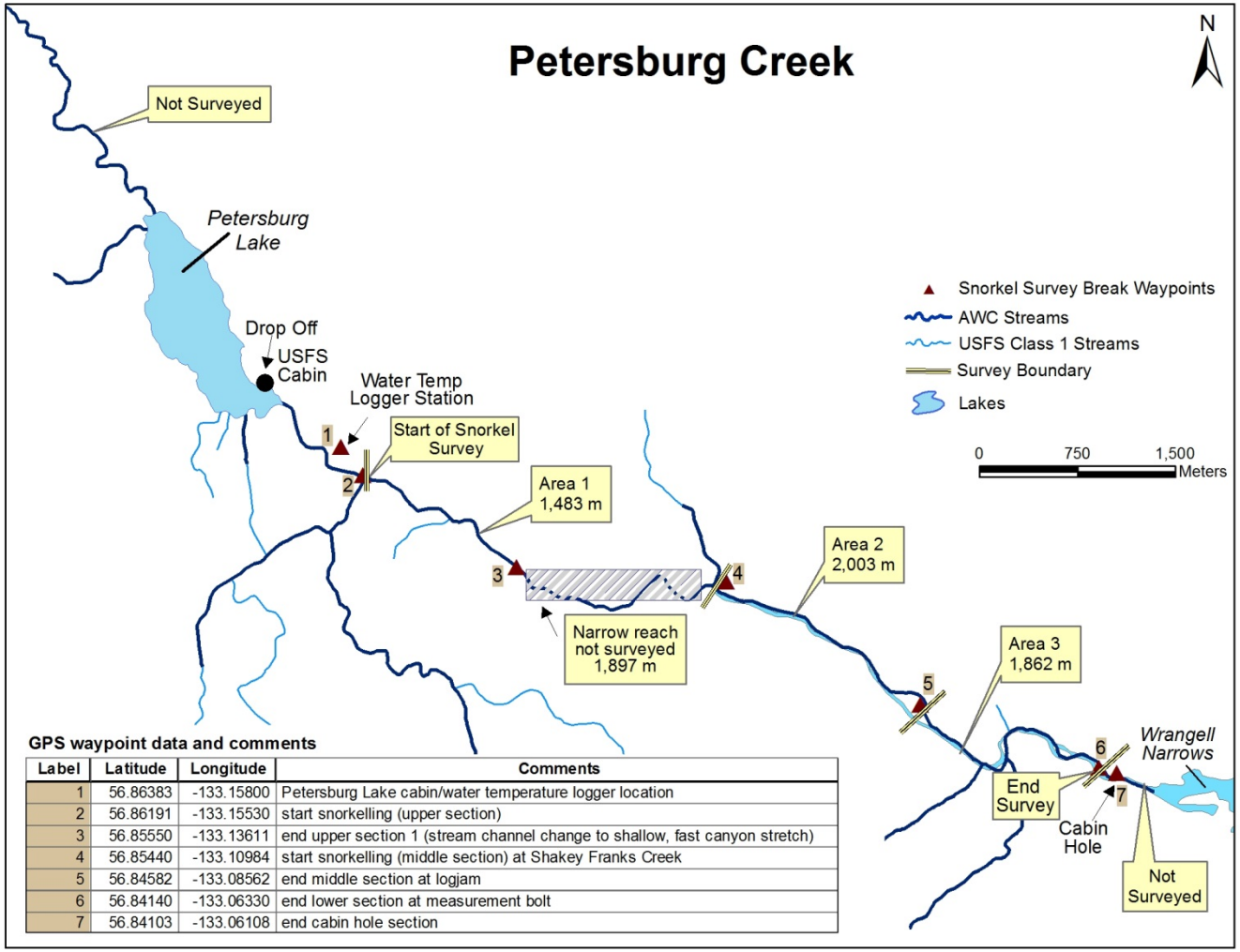
There was only one closure during the history of our snorkel surveys at Eagle/Luck Creek; along with other streams on Prince of Wales Island and Kosciusko Island, it was were closed by emergency order on November 9, 2004, to the retention of steelhead. During this closure steelhead needed to be released immediately and could not be removed from by water by anglers. This closure was to protect small runs of fall-run steelhead from potential overharvest because the "Federal Subsistence regulations for these areas provided for a winter season from December 1 through the last day of February, with a harvest limit of 2 per household" (E.O. No. 1-SH-B-26-04).

No subsistence harvest of steelhead was reported from Luck Creek during the 2012-2013 study period, but 5 steelhead were reported harvested in 2012 and 1 steelhead was reported harvested by subsistence users in 2013 from Eagle Creek. The reported harvest on the Harris River since 2003, when the federal government began managing subsistence fisheries in Alaska, was 24 steelhead as of 2013 (Jeff Reeves, compilation of subsistence harvest records, USFS Zoned Subsistence Biologist, Craig, Alaska). The Department of Interior subsistence regulations state that winter season subsistence harvest regulations (December 1 through the last day of February) are 2 steelhead trout per household on Prince of Wales Island. However, only 1 steelhead may be harvested by a household from a particular drainage. Spring season (March 1–May 31) subsistence steelhead harvest regulations are 5 steelhead trout per household. However, only 2 steelhead may be harvested by a household from a particular drainage. Gear is dip net, handline, spear, and rod and reel (http://www.doi.gov/subsistence/regulation/fish_shell/upload/Southeast.pdf).

APPENDIX G: PETERSBURG CREEK

Appendix G1.–Petersburg Creek, Petersburg Index Stream: AWC #106-44-10600.



GPS waypoint data and comments

Label	Latitude	Longitude	Comments
1	56.86383	-133.15800	Petersburg Lake cabin/water temperature logger location
2	56.86191	-133.15530	start snorkelling (upper section)
3	56.85550	-133.13611	end upper section 1 (stream channel change to shallow, fast canyon stretch)
4	56.85440	-133.10984	start snorkelling (middle section) at Shakey Franks Creek
5	56.84582	-133.08562	end middle section at logjam
6	56.84140	-133.06330	end lower section at measurement bolt
7	56.84103	-133.06108	end cabin hole section

Appendix G2.–Description and history of Petersburg Creek steelhead surveys, research and management.

Petersburg Creek (AWC#106-44-10600) is the outlet stream of Petersburg Lake and is located on Kupreanof Island across from Petersburg, Alaska, in the ADF&G DSF Petersburg Management Area. Petersburg Creek drains into Wrangell Narrows. Petersburg Creek has 3 reach areas that are currently surveyed, plus the Cabin Hole. This nomenclature can be confusing. From 2000-2004 the Cabin Hole was included in reach area 2 (Vera Goudima, Fish and Wildlife Technician for Petersburg Management Area personal communication) and in 2005–2011 was included in reach area 3. In this report the Cabin Hole is listed separately to spell out that it is included in the count. The Petersburg Area staff has kept the count separately in their field notes but adds it into the appropriate reach area on the form. The counts from the Cabin Hole are included on the regional trend line and have been in previous reports, albeit included in reach counts. Historically, Petersburg Creek has been surveyed with various numbers of reach areas, and originally the canyon was included but almost never done. Observation of field notes and discussions with long-term staff indicate that the total stream area surveyed has largely remained the same.

The area management staff from Petersburg generally flies to Petersburg Lake, snorkels downstream, and returns to Petersburg via boat. Due to the shallows at tidewater, the surveys are performed to end at a favorable tide.

Steelhead index surveys were begun in Petersburg Creek in 1997 and have occurred every year since then. Historically, 17 survey years resulted in 11 bracketed peak counts (65%) and 4 high counts (35%). Bracketed peak counts range from a high of 369 in 2005 to a low of 112 in 2012 with a median peak count of 221 as of 2013. Bracketed peak counts range from as early as 5/2 in 2006 to as late as 5/24 in 2012. **Survey counts from 1998 and 1999 were incomplete and have been reclassified in this report as high counts, not bracketed peak counts**.

Nichols and Williams (2012) included Petersburg Creek in their habitat surveys of prioritized waters from 2001–2003 for regional hydrography. They surveyed 22.1 km of habitat, which included both mainstem and tributaries. Their measurements of the extent of the index area were 7.19 km.

From 1971 to 1975, a “horse and deck” weir with both upstream and downstream traps was operated on Petersburg Creek during the spring. Estimated number of adult steelhead for 1971–1975 were 806, 536, 401, 369, and 329 (Jones 1976). Bryant and Lohr (1999) summarize Jones’ findings as an average of 38% repeat spawners (30-43%) of adults returning to Petersburg Creek. Jones (1976) summarizes the 1975 return as having 20 age classes ranging from 2.1s-5.2 but notes that several age classes seen in previous years were missing from the 1975 run. The most numerous of all age classes during the duration of the Petersburg Creek weir for all years for initial spawners were age classes 3.2 and 3.3. The mean fork length of adult initial spawners was 72.7 cm with a mean weight of 4 kg, whereas the mean fork length of repeat spawners during 1975 was 79.4 cm with a mean weight of 5.2 kg (Jones 1976). . Emigrant smolt counts from 1972–1975 declined and then rose: 1,251 smolt outmigrated in 1972, 423 outmigrated in 1973, 383 outmigrated in 1974, and 502 outmigrated in 1975 (Jones 1976).

Petersburg Creek also has coho, pink, and sockeye salmon, according to the Anadromous Waters Catalog, as well as resident Dolly Varden trout, cutthroat trout, and rainbow trout.

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Petersburg Creek, along with Falls Creek, was the original brood source for Crystal Lake Hatchery steelhead stock from 1974–1979 (Jones 1982). Egg takes began with Petersburg Creek stock in 1974, and in 1975, 8,000 142 mm steelhead smolt were returned to Petersburg Creek. In 1976, 6,500 170 mm smolt (a mixture of Petersburg Creek and Falls Creek stock) were planted in Petersburg Creek as well (Jones 1979). In 1977, Falls Creek steelhead were planted in Crystal Creek (Judy Lum/Bruce White, Alaska Department of Fish and Game, unpublished data). In 1978, Crystal Lake hatchery closed temporarily due to an outbreak of Infectious Hematopoietic Necrosis Virus (IHNV) and Bacterial Kidney Disease (BKD), and all steelhead fry were destroyed (Jones 1982). Other steelhead smolt from these egg takes were planted in Montana Creek in Juneau, Falls Creek in Petersburg, and Crystal Creek in Petersburg. Later broodstock for Crystal Lake Hatchery (1980-1993 brood years) utilized Falls Creek or Crystal Creek broodstock (Judy Lum/Bruce White, Alaska Department of Fish and Game, unpublished data).

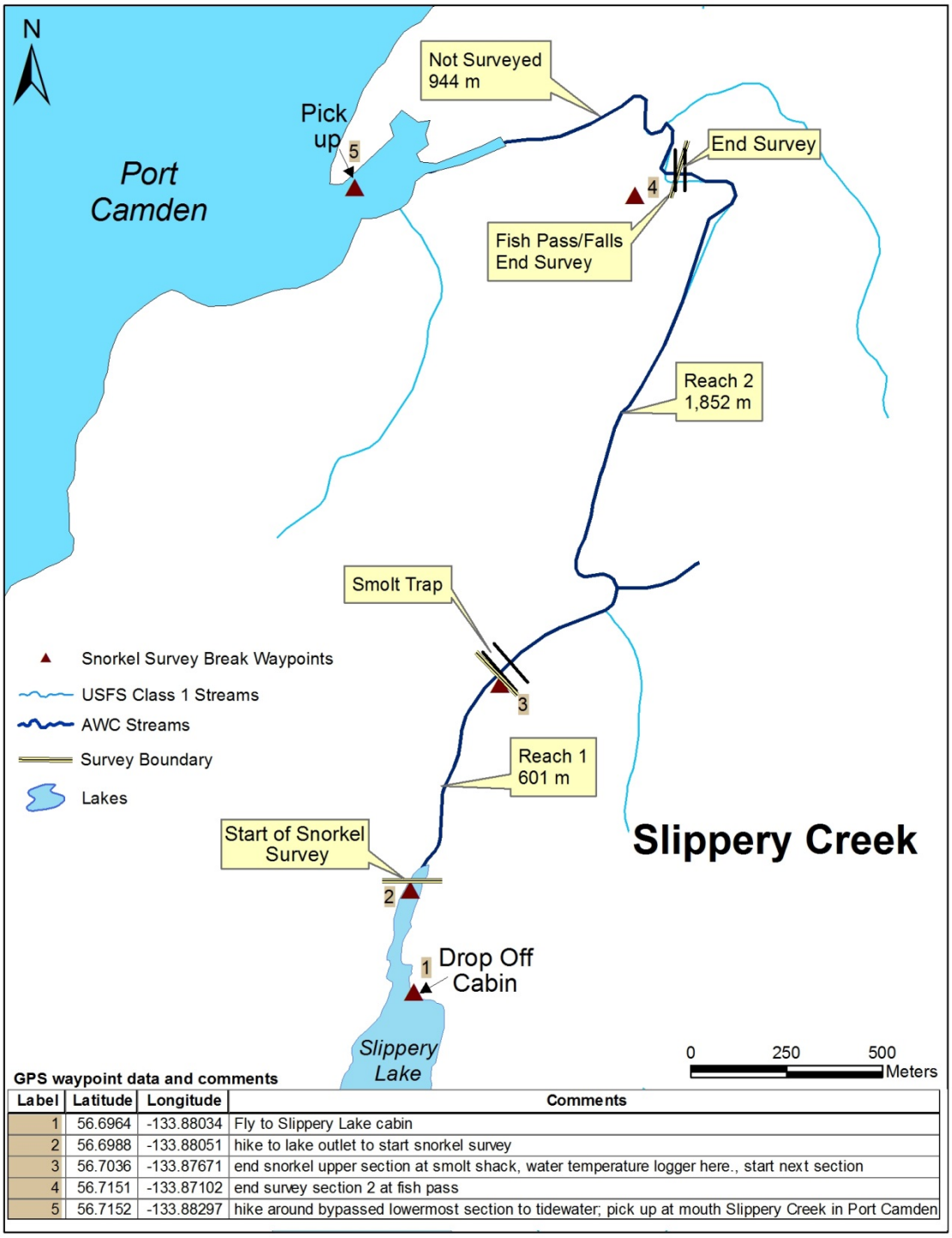
Petersburg Creek has predominantly a spring steelhead run that is ocean maturing. Fall run fish are not described per se, but Jones (1975) notes that the immigration of adult steelhead during the "spring" may start as early as February.

Petersburg Creek currently is managed under the Southeast Region steelhead regulation requiring a 36 inch minimum size limit with 1 fish daily and 2 in possession and a 2-fish annual limit with a harvest record required. Bait is prohibited (5 AAC 047.022). No estimates from the Statewide Harvest Survey for the reporting period 2012-2013 were available for Petersburg Creek (Alaska Sport Fishing Survey database [Intranet]. 1996– . Anchorage, AK: Alaska Department of Fish and Game, Division of Sport Fish [cited March 29, 2016]. Available from: https://intra.sf.adfg.state.ak.us/swhs_est/).

No subsistence harvest of steelhead has been reported in Petersburg Creek since 2003 when the federal government began managing subsistence fisheries in Alaska (Jeff Reeves, compilation of subsistence harvest records, USFS Zoned Subsistence Biologist, Craig, Alaska).

APPENDIX H: SLIPPERY CREEK

Appendix H1.–Slippery Creek, Petersburg Index Stream: AWC # 109-43-10030.



GPS waypoint data and comments

Label	Latitude	Longitude	Comments
1	56.6964	-133.88034	Fly to Slippery Lake cabin
2	56.6988	-133.88051	hike to lake outlet to start snorkel survey
3	56.7036	-133.87671	end snorkel upper section at smolt shack, water temperature logger here., start next section
4	56.7151	-133.87102	end survey section 2 at fish pass
5	56.7152	-133.88297	hike around bypassed lowermost section to tidewater; pick up at mouth Slippery Creek in Port Camden

Appendix H2.–Description and history of Slippery Creek steelhead surveys, research and management.

Slippery Creek (AWC#109-43-10030) is the outlet stream of Slippery Lake and is located on Kuiu Island is located on Kuiu Island in the ADF&G DSF Petersburg Management Area. Slippery Creek drains into Port Camden on the northeast part of the island. There are 2 reach areas that are currently surveyed. Originally in 2000 there were 3 reaches, but the third reach was dropped due to persistent low to nonexistent steelhead numbers in that reach in 2006. For consistency, counts in tables and charts in this report do not contain reach 3.

The area management staff from Petersburg generally flies to Slippery Lake, snorkels downstream and hikes to tidewater, and returns to Petersburg via floatplane. The flight is approximately 30 minutes to an hour long. Slippery Creek is perhaps the most remote of the 10 snorkel index streams.

Slippery Creek replaced Marten Creek as the Petersburg Management Areas second index stream in 2000. Steelhead index surveys have occurred annually from 2000-2004 and 2006-2012. No surveys occurred at Slippery Creek during 2005 and 2013. Historically, 12 survey years resulted in 7 bracketed peak counts (58%) and 5 high counts (42%). Bracketed peak counts range from a high of 92 in 2004 to a low of 46 in 2008 with a median peak count of 67 as of 2013. Bracketed peak counts range from as early as 5/6 in 2010 to as late as 5/22 in 2007.

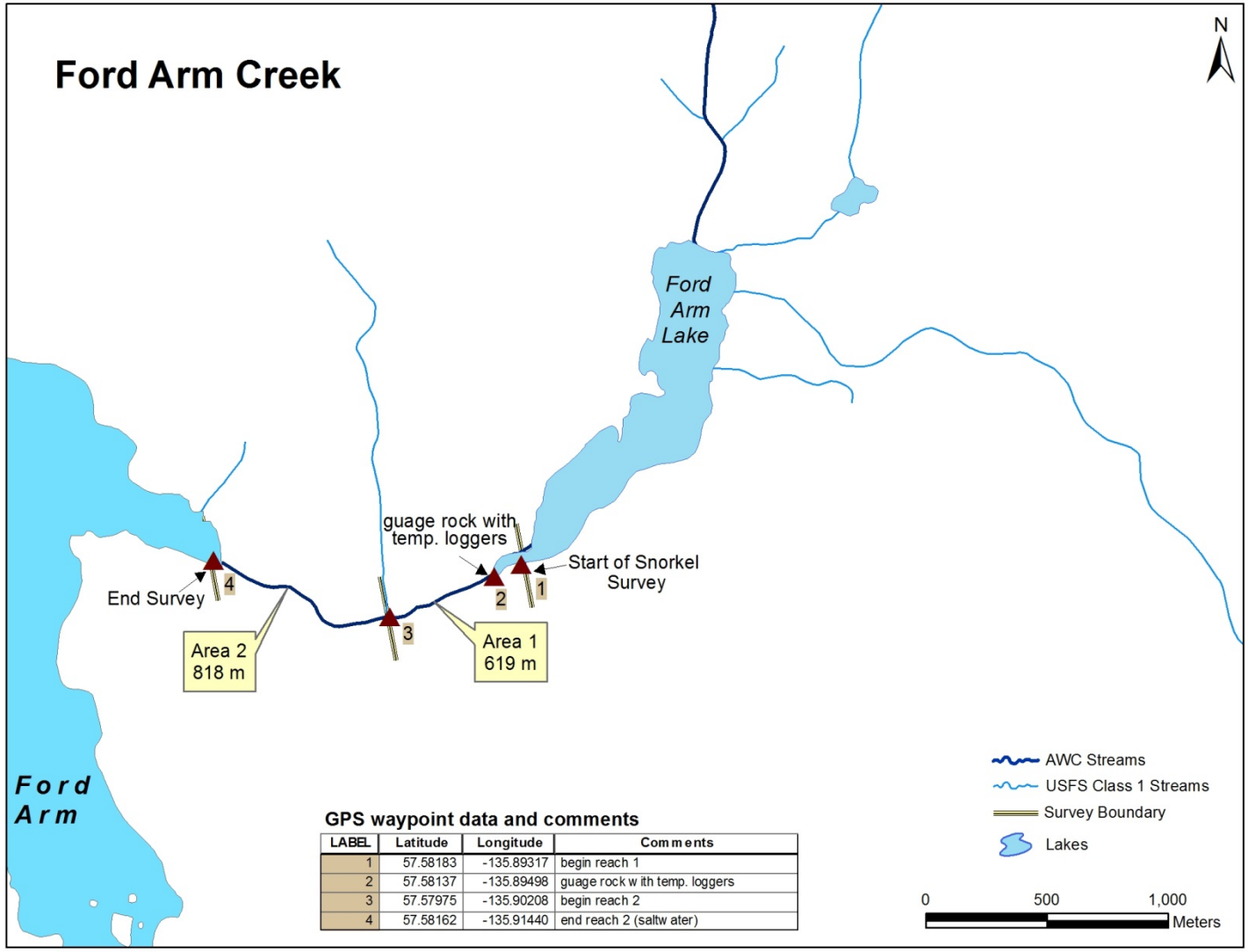
Slippery Creek has a spring steelhead run that is ocean maturing. Slippery Creek also has Chinook and (rearing) coho, according to the Anadromous Waters Catalog, as well as Dolly Varden trout. Slippery Creek is managed under the Southeast Region steelhead regulation requiring a 36-inch minimum size limit with 1 fish daily, 2 in possession, and a 2-fish annual limit with a harvest record required. Bait is prohibited. (5 AAC 047.22) No estimates from the Statewide Harvest Survey for the reporting period 2012-2013 were available for Slippery Creek (Alaska Sport Fishing Survey database [Intranet]. 1996– . Anchorage, AK: Alaska Department of Fish and Game, Division of Sport Fish [cited March 29, 2016]. Available from: https://intra.sf.adfg.state.ak.us/swhs_est/).

In 1987 the USFS put in a steep pass on Slippery Creek for coho enhancement approximately 1200 m up from saltwater. The USFS plans to relocate the fish ladder exit further downstream in upcoming seasons, which will include blasting. The fish pass is located just at the end of the second (last) reach of the snorkel survey. The fish pass has also given access to steelhead and other trout to the upper portion of Slippery Creek below the lake (Fleming 2010).

No subsistence harvest of steelhead has been reported in Slippery Creek since 2003 when the federal government began managing subsistence fisheries in Alaska (Jeff Reeves, compilation of subsistence harvest records, USFS Zoned Subsistence Biologist, Craig, Alaska).

APPENDIX I: FORD ARM CREEK

Appendix I1.–Ford Arm Creek, Sitka Index Stream: AWC # 113-73-10030.



GPS waypoint data and comments

LABEL	Latitude	Longitude	Comments
1	57.58183	-135.89317	begin reach 1
2	57.58137	-135.89498	guage rock w ith temp. loggers
3	57.57975	-135.90208	begin reach 2
4	57.58162	-135.91440	end reach 2 (saltw ater)

Appendix I2.–Description and history of Ford Arm Creek steelhead surveys, research and management.

Ford Arm Creek (AWC #113-73-10030), located approximately 75 km north of Sitka, is the outlet stream of Ford Arm Lake on the outer coast of Chichagof Island and drains into the Gulf of Alaska via Ford Arm and Khaz Bay/Solcum Arm in the Sitka Management Area. Ford Arm has a sport fishery for steelhead. Anglers have access via floatplane and boat. Ford Arm Creek watershed is in the Chichagof-Yakobi Wilderness area. Ford Arm Creek has 2 reach areas that are surveyed currently. Ford Arm Creek is the only index stream on the outer coast. Nichols and Williams (2012) described the Ford Arm watershed as draining approximately 2,540 ha and state that the watershed contains 11.3 km of anadromous fish habitat. Nichols and Williams (2012) also describe Ford Arm Creek in 22 reach sections by measured channel type, average gradient, density of macro pools, and density of large woody debris (LWD) for 8.64 km of stream length: average stream gradient ranges from 1.00-6.00%, density of macro pools ranged from 0.0-112.5 pools/km, and density of LWD ranged from 22.8-481.8 LWD/km.

Ford Arm Creek is a remote stream and the area management staff from Sitka flies for approximately 30 minutes to Ford Arm Lake, snorkels downstream, hikes out the beach, and is picked up by floatplane on the beach.

Steelhead index surveys were begun in Ford Arm Creek in 1997 and have occurred every year since then. Historically, 17 survey years resulted in 12 bracketed peak counts (71%) and 5 high counts (29%). Bracketed peak counts range from a high of 673 in 2007 to a low of 99 in 2010 with a median peak count of 188 as of 2013. Bracketed peak counts range from as early as 4/29 in 2005 to as late as 6/4 in 2008.

Shaul et al. (2014) demonstrate the relationship between an upsurge in pink salmon escapement to Ford Arm and a subsequent increase in coho salmon presmolt production as well as an approximate doubling of adult coho escapement from 1982-2009. This relationship can be largely explained by the increase of marine derived nutrients from pink salmon carcasses into the freshwater food chain (Shaul et al. 2014). Steelhead index counts in Ford Arm Creek since 1997 also appear to have increased, but steelhead index counts between 1997-2002 (except 2000) are not bracketed peak counts, and 3 of these counts (1997, 1998, 1999) are composed of 2 surveys and 1 count is only 1 survey (2001). The record 2007 steelhead bracketed peak count of 673 adult steelhead at Ford Arm followed 6-7 years after record pink returns in 1999 and 2000, which accounts for an average freshwater age of 3 steelhead smolt and an average 3 years in the ocean (Shaul and Geiger 2012). Shaul and Geiger (2012) posit that steelhead in Ford Arm watershed could be similarly affected by introduction of marine-derived nutrients from increased numbers of pink salmon carcasses.

Ford Arm Creek is predominately a spring steelhead run that is ocean maturing. Fall steelhead are not described. No steelhead were observed going through the trap of the coho weir, which operated annually from early August to late October from 1982–present (Shaul et al. 2014). Only one steelhead was ever observed on a stream survey during August from 1990-2010 (Ken Koolmo, retired Fish and Wildlife Technician, personal communication). In 1993 a summer steelhead run of 27 fish was described by Shaul et al. (2014), but it was very unusual. Shaul et al. (2014) state that on no other year (of 23) did they find evidence of a summer run of steelhead in Ford Arm.

Ford Arm Creek also has coho, chum, sockeye, and pink salmon, according to the Anadromous Waters Catalog, as well as Dolly Varden trout, cutthroat trout, and rainbow trout.

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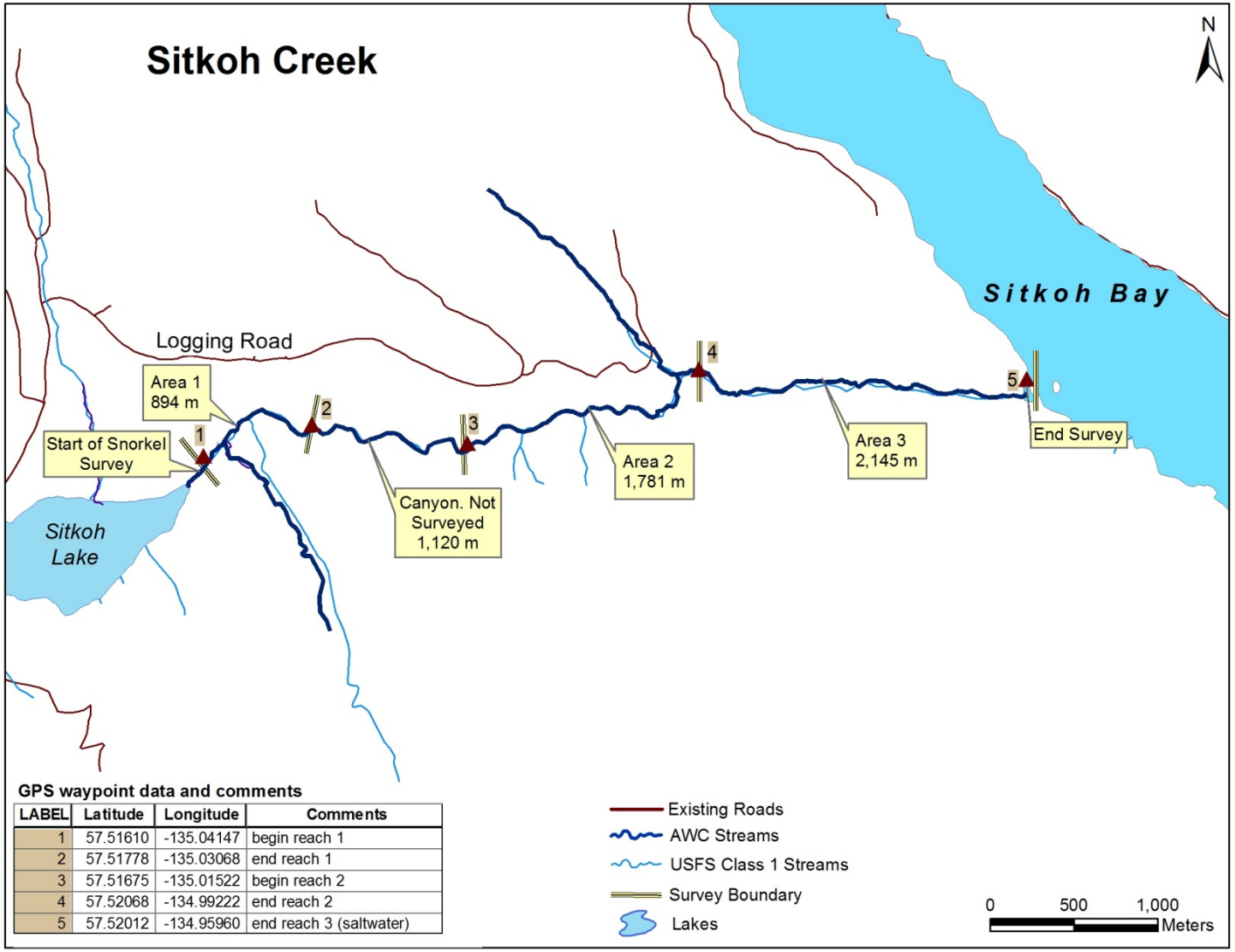
Ford Arm Creek steelhead sport fishery is still managed under the Southeast Region steelhead regulation requiring a 36-inch minimum size limit with 1 fish daily, 2 in possession, and a 2-fish annual limit with a harvest record required. Bait is prohibited. (5 AAC 047.22) No estimates from the Statewide Harvest Survey for the reporting period 2012–2013 were available for Ford Arm Creek (Alaska Sport Fishing Survey database [Intranet]. 1996– . Anchorage, AK: Alaska Department of Fish and Game, Division of Sport Fish [cited March 29, 2016]. Available from: https://intra.sf.adfg.state.ak.us/swhs_est/).

No subsistence harvest of steelhead was reported on Ford Arm Creek during the 2012-2013 study period. The reported harvest on Ford Arm Creek since 2003 when the federal government began managing subsistence fisheries in Alaska was 1 steelhead caught in 2007 (Jeff Reeves, compilation of subsistence harvest records, USFS Zoned Subsistence Biologist, Craig, Alaska).

APPENDIX J: SITKOH CREEK

Appendix J1.–Sitkoh Creek, Sitka Index Stream: AWC # 113-59-10040.



Sitkoh Creek (AWC # 113-59-10040) is the outlet stream of Sitkoh Lake on the east side of Chichagof Island and drains into Chatham Straight via Sitkoh Bay in the Sitka Management Area. It is a popular sport fishing stream in spite of its remote location. Anglers have access via floatplane and boat. Sitkoh Creek has 3 reach areas that are surveyed currently. From 2003–2009, while the steelhead weir was operated by ADF&G DSF, the third reach was split to accommodate the weir but covered the same linear distance.

Sitkoh Creek is a remote stream and the area management staff from Sitka flies for approximately 30 minutes to Sitkoh Lake, snorkels downstream, hikes out the beach, and is picked up by floatplane on the beach.

Steelhead index surveys were begun in Sitkoh Creek in 1997 and have occurred every year since then. Historically, 17 survey years resulted in 9 bracketed peak counts (53%) and 8 high counts (47%). Bracketed peak counts range from a high of 354 in 2004 to a low of 68 in 2011 with a median peak count of 201 as of 2013. Bracketed peak counts range from as early as 4/30 in 2003 to as late as 5/28 in 2009.

Sitkoh Creek is predominately a spring steelhead run that is ocean maturing (Love et al. 2012). Sitkoh Creek also has Chinook, coho, and pink salmon, according to the Anadromous Waters Catalog, as well as Dolly Varden trout, cutthroat trout, and rainbow trout.

Sitkoh Creek is one of the most studied steelhead systems in SEAK. The creek had an established weir as early as 1936 and 1937 by the U.S. Bureau of Fisheries (the precursor agency to the U.S. Fish and Wildlife Service) (Chipperfield 1938). ADF&G DSF established weirs during the steelhead return in 1982, 1990, 1993, and 1996 and then again from 2003–2009, which included both upstream and downstream traps (Jones 1983, Jones et al. 1991, Harding and Jones 1994, Yanuz 1997, Love and Harding 2008, 2009, Love et al. 2012a-b). Escapement counts for all weirs on Sitkoh were summarized in Love et al. 2012b. Steelhead escapement counts on Sitkoh Creek for 1936 and 1937 were 760 and 1,108. By 1982, the escapement count was 690. During the 1990s the escapement counts were 661 (1990) , 520 (1993), and 926 (1996). The 2003–2009 weir included an upstream/downstream trap and the project had objectives to estimate adult and smolt production, age smolt and returning adults (which were PIT tagged), estimate repeat spawning rates, estimate kelting rates, and estimate smolts per spawner (SPS). Adult escapement estimates included a Peterson estimate to account for any fish that may have been upstream prior to the weir operations or escaped the weir (weir counts averaged 97% of the estimate) and the escapement estimates were 682, 780, 574, 416, 418, 513, and 408 for an average escapement of 542 adult steelhead. Kelting rates ranged from 63% to 88%. The 2003–2009 adults averaged 67% female and 33% males. Smolt emigration ranged from a high of 3,742 in 2004 to 893 in 2009. Approximately 80% of the smolt were freshwater ages 3 and 4. Marine survival of returning adults from smolt emigrations during 2003-2006 were 6.2%, 4.4%, 5.7%, and 7.9%. First-time spawners tended to spend 2-3 years in the ocean. Repeat spawners made up 34% of the returning adults, and smolts per spawner were estimated to be 3.5 from the 2003 brood year (Love et al. 2012b).

As a result of the overlap between the weir operation and annual steelhead snorkel surveys, DSF was able to estimate a calibration factor for 2 years. On average the snorkel teams combined for 2008 and 2009 were seeing 44.3% of the fish above the weir for a calibration factor of $\pi = 2.26$ (Harding 2012). Caution should be used when using this expansion factor because it represents only 2 years of pair counts.

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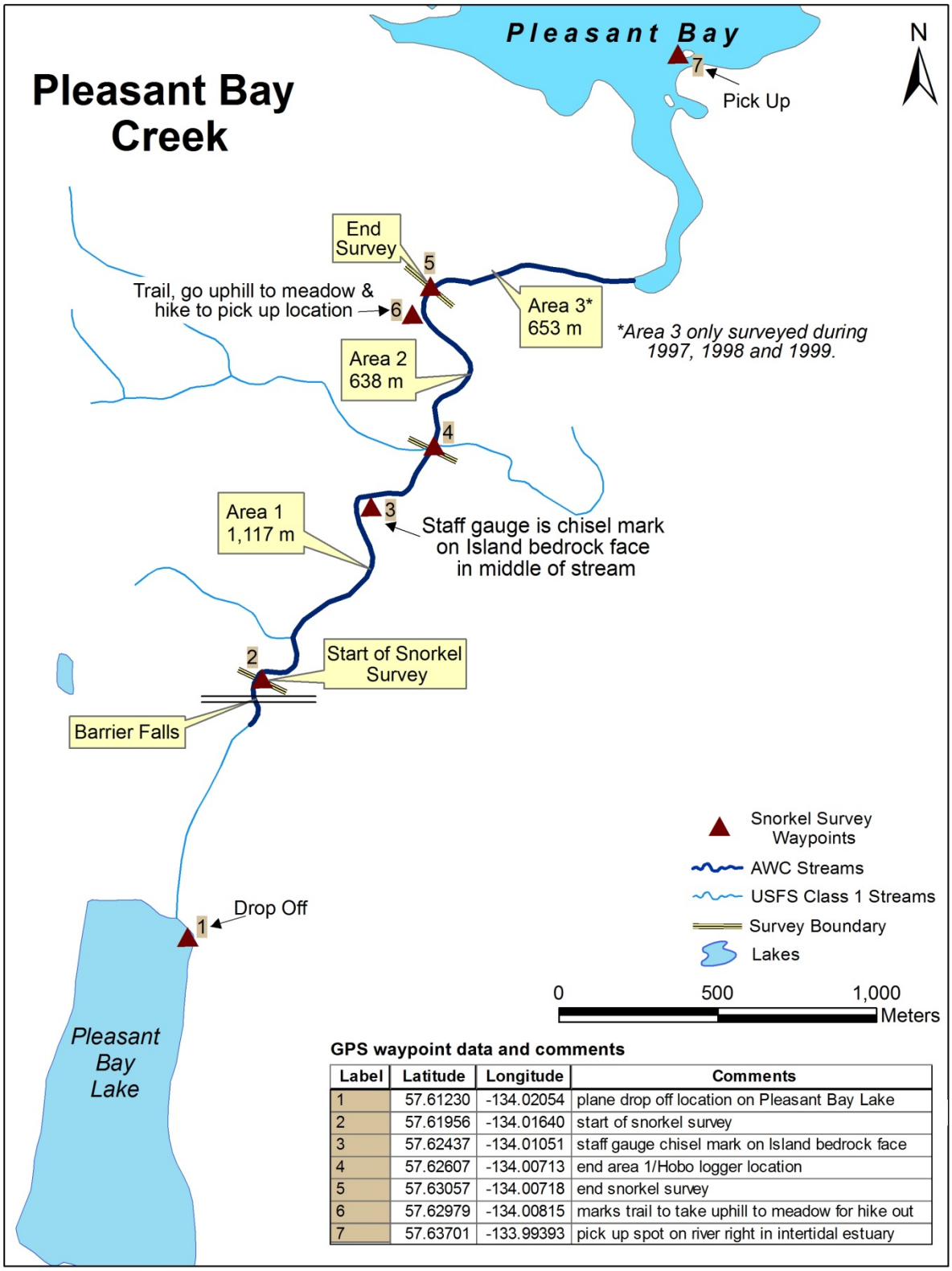
Crupi and Nichols (2012b) estimated that the useable habitat area of Sitkoh Creek was 158 steelhead smolt/hectare and 35 adult steelhead/hectare. Adults were only observed using mainstem habitat and juveniles were observed using both mainstem and tributary habitat. Scour pools were the predominant habitat where adults were observed.

Sitkoh Creek is still managed under the Southeast Region steelhead regulation requiring a 36-inch minimum size limit with 1 fish daily, 2 in possession and a 2-fish annual limit with a harvest record required. Bait is prohibited. No estimates from the Statewide Harvest Survey for the reporting period 2012-2013 were available for Ford Arm Creek (Alaska Sport Fishing Survey database [Intranet]. 1996– . Anchorage, AK: Alaska Department of Fish and Game, Division of Sport Fish [cited March 29, 2016]. Available from: https://intra.sf.adfg.state.ak.us/swhs_est/).

No subsistence harvest of steelhead has been reported in Sitkoh Creek since 2003 when the federal government began managing subsistence fisheries in Alaska (Jeff Reeves, compilation of subsistence harvest records, USFS Zoned Subsistence Biologist, Craig, Alaska).

APPENDIX K: PLEASANT BAY CREEK

Appendix K1.–Pleasant Bay Creek, Juneau Index Stream: AWC # 111-12-10050.



GPS waypoint data and comments

Label	Latitude	Longitude	Comments
1	57.61230	-134.02054	plane drop off location on Pleasant Bay Lake
2	57.61956	-134.01640	start of snorkel survey
3	57.62437	-134.01051	staff gauge chisel mark on Island bedrock face
4	57.62607	-134.00713	end area 1/Hobo logger location
5	57.63057	-134.00718	end snorkel survey
6	57.62979	-134.00815	marks trail to take uphill to meadow for hike out
7	57.63701	-133.99393	pick up spot on river right in intertidal estuary

Appendix K2.–Description and history of Pleasant Bay Creek steelhead surveys, research and management.

Pleasant Bay Creek (AWC # 111-12-10050), located on eastern Admiralty Island approximately 50 miles south of Juneau, is the outlet stream of Pleasant Bay Lake in Seymour Canal and drains into Stephens Passage in the Juneau Management Area. Pleasant Bay Creek is in the Admiralty Island National Monument Kootsnoowoo Wilderness Area. Pleasant Bay Creek receives light sport fishing for steelhead because it is remote, although Jones (1980) considered the sport fishing pressure in the 1970s heavy from the crews of commercial herring fleet. Currently anglers have access via floatplane and boat. Pleasant Bay Creek has 2 reach areas that are surveyed currently but originally had 3 reach areas. Reach area 3 was dropped in 2000 because very few fish were seen there.

Pleasant Bay Creek is a remote stream and the area management staff from Juneau flies for approximately 30 minutes to Pleasant Bay Lake, hikes down to the barrier falls, snorkels downstream, hikes out the beach, and is picked up by floatplane on the beach. Pleasant Bay Creek has very clear water that our management staff describes as “gin-clear”.

Steelhead index surveys were begun in Pleasant Bay Creek in 1997 and have occurred every year since then. Historically, 17 survey years resulted in 10 bracketed peak counts (59%) and 7 high counts. Bracketed peak counts range from a high of 94 in 2011 to a low of 36 in 2002 with a median peak count of 53 as of 2013. Bracketed peak counts range from as early as 5/1 in 2003 to as late as 5/22 in 2007.

Nichols and Williams (2012) described the Pleasant Bay watershed as draining approximately 3,767 ha and state that the watershed contains 2.6 km of anadromous fish habitat. Nichols and Williams (2012) also describe Pleasant Bay Creek in 8 reach sections by measured channel type, average gradient, density of macro pools and density of large woody debris for 8.43 km of stream length: average stream gradient ranged from 1.00-3.5%, density of macro pools ranged from 5.6-29.0 pools/km, and density of LWD ranged from 55.2-222.6 LWD/km.

A 1971 ADF&G memo describes the “clearance work” that took place June 15-18, 1971. They burned the old Fish and Game weir cabin and removed some large windfalls in the upper portion of the stream (which I presume was above the barrier falls) in some riffle areas (ADF&G unpublished data in Region I catalog and inventory files, Douglas, Alaska).

Pleasant Bay Creek was the site of a weir during 1986 and 1987 to enumerate and estimate stream residence time for pink salmon (Dangel and Jones 1988).

In 1964 Pleasant Bay Creek steelhead were the brood source for 17,388 steelhead stocked into Peterson Creek/Lake (note that there were various sources from 1919-1968) (Harding and Jones 1992).

Pleasant Bay Creek also has coho and pink salmon, according to the Anadromous Waters Catalog, as well as Dolly Varden trout, cutthroat trout, and rainbow trout.

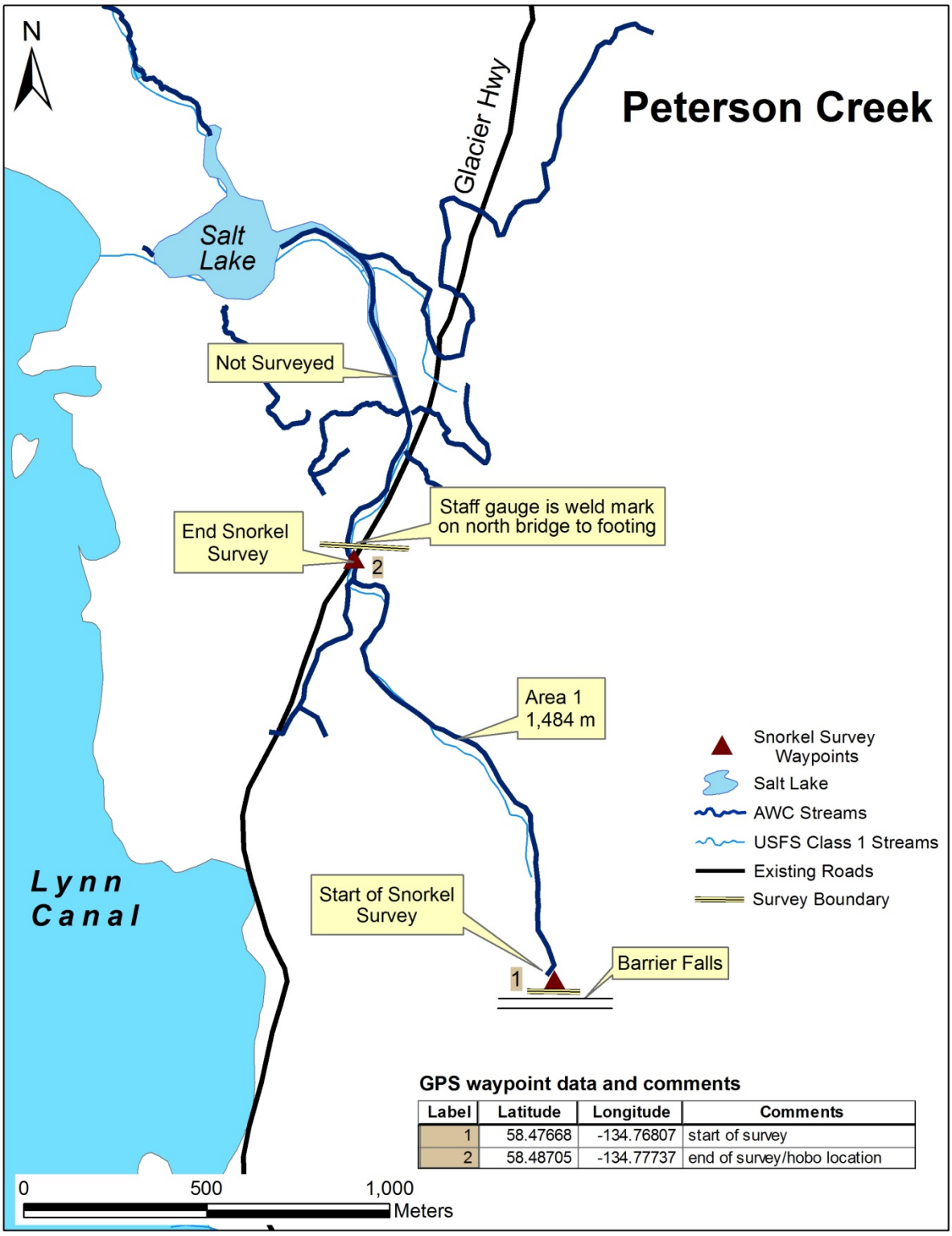
Pleasant Bay Creek is a spring steelhead run that is ocean maturing. Fall steelhead are not described.

The Pleasant Bay Creek steelhead sport fishery is still managed under the Southeast Region steelhead regulation requiring a 36-inch minimum size limit with 1 fish daily, 2 in possession, and a 2-fish annual limit with a harvest record required. Bait is prohibited. (5 AAC 047.022)

No subsistence harvest of steelhead has been reported in Pleasant Bay Creek since 2003 when the federal government began managing subsistence fisheries in Alaska (Jeff Reeves, compilation of subsistence harvest records, USFS Zoned Subsistence Biologist, Craig, Alaska).

APPENDIX L: PETERSON CREEK

Appendix L1.–Peterson Creek, Juneau Index Stream: AWC # 111-50-10100.



GPS waypoint data and comments

Label	Latitude	Longitude	Comments
1	58.47668	-134.76807	start of survey
2	58.48705	-134.77737	end of survey/hobo location

Appendix L2.–Description and history of Peterson Creek steelhead surveys.

Peterson Creek (AWC #111-50-10100), the outlet stream of Peterson Lake is located on the road system in Juneau at approximately mile 25 Glacier Highway north of Juneau. Peterson Creek is a popular fishing stream in the Juneau roadside sport fishery. Peterson Creek is a brown-water stream and has only 1 reach area that is surveyed from a barrier falls approximately 2 km up the creek from the highway down to the highway bridge. Although it was never included in the Peterson Creek index survey counts, in 1997 there was a second reach below the highway the bridge that was surveyed occasionally during 1997. This reach was eliminated due to poor visibility of fish in this section (Roger Harding, retired Fisheries Biologist, personal communication).

Peterson Creek is unique because just at the outlet a salt chuck exists that is tidally influenced when tides are above 5 m. A rock barrier exists that precludes fish entry until tides reach that height. Peterson Creek drains into Lynn Canal via Amalga Harbor.

Crupi and Nichols (2012a) described the Peterson Creek watershed as draining 2,647 ha and state that the watershed contains approximately 3 km of anadromous fish habitat. Crupi and Nichols (2012) further define the anadromous fish habitat from fish use surveys from 2007–2008 as 4.53 ha of adult steelhead useable habitat along and combined with steelhead juvenile habitat to total 5.30 ha. They further quantify the total useable habitat area for adult steelhead as 38.7 adults/ha. The snorkel surveys Crupi and Nichols (2012) performed for this useable habitat determination included the 1,474 meters that DSF surveys annually as well as the entire creek downstream of the bridge to the salt chuck.

Interest in steelhead production at Peterson Creek began in the 1960s. In mid-June, 1961 Peterson Lake was treated with rotenone to rid the lake of stunted Dolly Varden, and subsequently stocked with steelhead juveniles to improve production of steelhead in the Peterson Lake watershed. This resulted in a fish kill that included steelhead juveniles in Peterson Creek (ADF&G, unpublished data). Steelhead adults would not have been present this late in the spring. From 1962-1968 Peterson Lake was stocked with steelhead fry from Lake Eva, Ward Lake, and Pleasant Bay Lake (Harding and Jones 1991). The creek was managed from 1961 through 1989 with the belief that stocked steelhead/rainbow trout rearing in the lake served as a source of recruitment for Peterson Creek steelhead. However, a study conducted in 1990 and 1991 failed to capture marked rainbow/steelhead smolt emigrating from above the barrier falls and contributing to the steelhead production (Harding and Jones 1991).

Steelhead index surveys were begun in Peterson Creek in 1997 and have occurred every year since then. Historically, 17 survey years resulted in 13 bracketed peak counts (76%) and 4 high counts. Bracketed peak counts range from a high of 41 adult steelhead in 2001 to a low of 12 adult steelhead in 2012 with a median peak count of 26 adult steelhead as of 2013. Bracketed peak counts range from as early as 5/4 in 1998 to as late as 5/24 in 2011. Peterson Creek has had 2 very low bracketed peak counts since 1997. In 2002 the bracketed peak count dropped to 13, and in 2012 a record low count was recorded for Peterson Creek during 2012 (12 fish vs. median count of 26 fish). Fortunately, the counts rebounded in ensuing years. Peterson Creek ranks 7th in density of steelhead in the 10 index streams with just 0.0175 steelhead/m surveyed (using the median count as of 2013).

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Counts from the 1989-1991 adult steelhead weir operated just upstream of the salt chuck on Peterson Creek were 222, 179, and 215 (Harding and Jones 1991). Adult steelhead from these studies averaged 743 mm in length, and had predominant age groups of 3.2, 4.2 and 3.2S1. Repeat spawning rates of aged adult steelhead were 70% for 1989, 68% for 1990, and 33% for 1991. Peterson Creek was also a test site for assessing both a resistivity counter and a DIDSON for electronically counting adult steelhead in small streams without handling from 2007-2009 (Coyle and Reed 2012a, 2012b). Neither were suitable: I presume the resistivity counter did not operate well at the very low water conductivities experienced in Peterson Creek (average = 13.9 μS/cm specific conductivity [EC]) during 2007 and had multiple problems during 2008; the upstream/downstream behavior of steelhead in Peterson Creek caused a gross inflation of the number of actual steelhead in the stream when using a DIDSON. In 2010 and 2011 a weir was once again installed on Peterson Creek to count immigrating steelhead adults, but this time the weir was operated just below the bridge on Glacier Highway to avoid the lack of attraction flow experienced at the original weir site just upstream from the salt lake (Coyle 2012). In 2010, 114 immigrant steelhead adults were counted through the weir, and in 2011, 133 immigrant steelhead were counted through the weir, approximately half of the fish counted during the 1989-1991 period (Coyle 2012).

Harding and Jones (1990 and 1991) estimated 2,121 angler hours were spent catching steelhead on Peterson Creek during 1989, and 2,865 angler hours were spent during 1990.

Concurrent weir counts and snorkel surveys during 2009 and 2010 allowed for the development of an expansion factor for this period at Peterson Creek. Caution should be used when using this expansion factor because it represents only 2 years of paired counts. On average the snorkel teams combined for 2009 and 2010 were seeing 24% of the fish above the weir, a calibration factor of $\pi = 4.09$ (Coyle 2012)

Hood et al. (2007) measured salmon-derived nutrients in Peterson Creek below and above the falls (control) from June-October 2004. They demonstrated the increase in ammonium, nitrate, soluble reactive phosphorous, dissolved organic nitrogen, and dissolved organic carbon, among other nutrients, during salmon spawning (primarily August and September) that help fertilize the base of the food web in lower Peterson Creek.

Peterson Creek served as a brood source for steelhead enhancement for Snettisham Hatchery (ADF&G FRED Division). From 1983-1987, 177 adult steelhead were removed from Peterson Creek during egg takes (Harding 1991). Peterson Creek steelhead reared at Snettisham Hatchery were extremely prone to any elevation in total dissolved gas and, owing to the very cold water temperatures at Snettisham, grew very slowly (Coyle ADF&G, Fish Culturist Snettisham Hatchery 1983-1992, unpublished data). Steelhead smolt from the 1984 and 1986 egg takes were planted into Montana Creek in 1987 (2,353) and 1990 (5,998) (Judy Lum/Bruce White, ADF&G, Fisheries Biologists, unpublished data). The 1983 and 1985 broods were destroyed due to Infectious Haematopoietic Necrosis Virus (IHNV) and Bacterial Kidney Disease (BKD) (Ron Josephson, Hatchery Coordinator, ADF&G, unpublished data). No progeny from these egg takes were ever returned to Peterson Creek.

Peterson Creek is a spring steelhead run that is ocean maturing. Fall steelhead are not described.

Peterson Creek also has Chinook, coho, chum, and pink salmon, according to the Anadromous Waters Catalog, as well as Dolly Varden trout, cutthroat trout, and rainbow trout. Douglas Island Pink and Chum, Inc. (DIPAC), a local private nonprofit salmon hatchery, operates net pens for short-term rearing of chum salmon fry in front of the outlet of Peterson Creek in the spring during the steelhead return. DIPAC puts up a barrier net for stray chum salmon returning at the mouth of Peterson beginning around July 1 annually after the steelhead have left Peterson Creek. This to allow a maximum escapement of 3,000 chum salmon into the creek (MSH Annual Management Plan).

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The Peterson Creek steelhead sport fishery is very popular. Since the 1989–1991 weir operations at Peterson Creek, sport fishing regulations became progressively more conservative. In 1989 anglers were allowed to use bait and harvest, and in 1992 ADF&G issued an emergency order to close 24 streams in SEAK (these were fall-run steelhead streams and did not include Peterson Creek) and restrict the use of bait. In 1993 the Emergency Order was expanded to close 48 streams to the retention of steelhead as well as imposing bait restrictions. Beginning in 1994 anglers were only allowed to only harvest fish 36 inches or greater in length, and in 2009 Peterson Creek was closed to the retention of steelhead along with other Juneau roadside streams as well as a bait prohibition. The Peterson Creek steelhead sport fishery is managed as catch and release only. All steelhead caught must be released immediately. No bait. (5 AAC 47.023) Peterson Creek is a small steelhead system on a road system in the largest town in SEAK. Anglers fishing for steelhead on Peterson Creek as well as other streams, especially ones closed to retention, should be encouraged to use catch-and-release best practices including using barbless hooks, not playing the fish any longer than necessary, not lifting the fish from the water, holding the fish horizontally and cradling its belly if a fish has to be held, removing the hook (if possible without touching the fish) using long nose pliers or hemostats, releasing the fish promptly, taking photos quickly, and reviving fish in low flow facing the current until it is able to swim off by itself. No estimates from the Statewide Harvest Survey for the reporting period 2012-2013 were available for Peterson Creek (Alaska Sport Fishing Survey database [Intranet]. 1996– . Anchorage, AK: Alaska Department of Fish and Game, Division of Sport Fish [cited March 29, 2016]. Available from: https://intra.sf.adfg.state.ak.us/swhs_est/).

No subsistence harvest of steelhead has been reported in Peterson Creek since 2003 when the federal government began managing subsistence fisheries in Alaska (Jeff Reeves, compilation of subsistence harvest records, USFS Zoned Subsistence Biologist, Craig, Alaska). Juneau is considered an urban area (along with Ketchikan), but a qualified user with a subsistence permit could subsistence fish for steelhead in Peterson Creek.

APPENDIX M: ARCHIVED DATA

Appendix M1.–Data files used for analyses of this project and archived.

File name	Description
STH data_2012-2013.xlsx	Steelhead snorkel survey data 1997-2013
PetersburgCreek02_14.xlsx	Complete stream temperature record for Petersburg Creek
EagleCreek03_14.xlsx	Complete stream temperature record for Eagle Creek
FordArmCr02_14.xlsx	Complete stream temperature record for Ford Arm Creek
HarrisRiver02_14.xlsx	Complete stream temperature record for Harris River
PetersonCreek02_13.xlsx	Complete stream temperature record for Peterson Creek
PleasantBayCreek2009_2011.xlsx	Complete stream temperature record for Pleasant Bay Creek
SitkohCreek03_14.xlsx	Complete stream temperature record for Sitkoh Creek
SlipperyCreek07_12.xlsx	Complete stream temperature record for Slippery Creek
WhiteRiver_02_14.xlsx	Complete stream temperature record for White River